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ABSTRACT

Intended for geography students, professors, and researchers, this publication deals with the process of political redistricting and shows how geographers can help devise plans that are responsible to office-holders, to voters, to legitimate community interests, and to a sense of territorial integrity. There are eight chapters. Chapter 1 examines the territorial basis of redistricting. Chapter 2, focusing on redistricting in the United States, discusses malapportionment and gerrymandering. The third chapter looks at criteria for redistricting, discussing constitutional, geographic, political-geographic, and political criteria. Electoral reform is the focus of chapter 4. Redistricting methods are examined in chapter 5. Chapters 6 and 7 deal with redistricting in the Mississippi legislature and in the State of Washington, respectively. The concluding chapter emphasizes the importance of a sense of community in the drawing of electoral districts. A bibliography is provided. (RM)

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POLITICAL REDISTRICTING AND GEOGRAPHIC THEORY

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SO 015 003

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Foreword

As a result of the 1980 Census of Population, seventeen United States congressional seats will depart from northcentral and northeastern states for southern and western destinations. Twenty-one states will be involved in this interstate transfer of national political influence. However, most other states will join the 21 in redrawing their congressional district boundaries. The reallocation of seats and redrawing of electoral boundaries will also affect state legislatures and local governments. National political parties, as well as citizen groups, will participate in the redistricting process through public initiative or influence on legislative bodies. In many situations, the process will eventually involve the court — whether challenges to the validity of census data as a basis for apportionment and districting, or challenges to the appropriateness and fairness of redistricting plans.

The process of redistricting is fundamentally a problem of geographical regionalization — at least so long as we view representation to be territorial in nature. Most prominent among geographers who have had important roles in redistricting is Richard Morrill, court-appointed Special Master for redistricting plans in Washington and a redistricting consultant for Mississippi. In this monograph, Professor Morrill shares not only his own experiences in Washington and Mississippi but also his ideas on the nature of representation and the process of redistricting.

It is appropriate that this book, the first of the **Resource Publications in Geography** series, addresses a topic as current, important, and ubiquitous as redistricting. This monograph series is sponsored by the Association of American Geographers, a professional organization whose purpose is to advance studies in geography and to encourage the application of geographic research in education, government, and business. Through its contribution to political life, geographic research affects all of us.

Resource Publications in Geography traces its origins to the Association's Commission on College Geography, whose *Resource Papers* were launched in 1968. Eventually 28 papers were published under sponsorship of the Commission through 1974 with the assistance of the National Science Foundation. Continued NSF support after completion of the Commission's work permitted the *Resource Papers for College Geography* to meet the original series goals over an additional four years and sixteen volumes:

> *The Resource Papers have been developed as expository documents for the use of both the student and the instructor. They are experimental in that they are designed to supplement existing texts and to fill a gap between significant research in American geography and readily accessible materials. The papers are concerned with important concepts or topics in modern geography and focus on one of three general themes: geographic theory; policy implications; or contemporary social relevance. They are designed to implement a variety of undergraduate college geography courses at the introductory and advanced level.*

The popularity and usefulness of the two series suggested the importance of their continuation after 1978 once a self-supporting basis for their publication had been established.

For this inaugural volume of **Resource Publications** in 1981, the original goals remain paramount. However, they have been broadened to include the continuing education of professional geographers as well as communication with the public on contemporary issues of geographic relevance. This monograph was developed, printed and distributed under the auspices of the Association, whose members served in advisory and review roles during its preparation. The ideas presented, however, are those of the author and do not imply AAG endorsement.

For our students, we hope that this book will stimulate thought about representative government and geographical problems in making government function. For our friends in political office, we trust that this volume will assist in the redistricting task. For fellow geographers, we intend that this sharing of professional experience and insight will enhance our local role as participants in redistricting.

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Richard L. Morrill

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1

The Territorial Basis of Redistricting

Much has been written about reapportionment and redistricting, especially by political scientists, inasmuch as the problem of devising new electoral districts as conditions change is obviously political (Public Affairs Information Service 1978). The process is political in that the design and approval of systems of districts is usually done by bodies of elected representatives; the balance of power between groups and areas is often involved; identification of citizens with a traditional electoral territory is altered; and the incumbency of individuals is usually at stake.

Redistricting is also territorial — a matter of spatial arrangement and organization (Johnston 1979). Thus the process is *geographic* in that areas must be allocated to districts and boundaries drawn (or territories partitioned into districts); communities of interest, which may have arisen in part from the pre-existing system of districts, may well be affected; restructuring of the basic electoral geography is altered; and accessibility of voters to their representatives or centers of decision-making may be changed. It is also appropriate for geographers, who by definition are concerned with spatial structure, to develop interest and capability in the reapportionment-redistricting process (Cope 1971).

Redistricting is also *statistical* or mathematical in that there is a requirement for reasonably current and accurate data on population and its characteristics and, sometimes, of property and its valuation. There are statistical procedures for evaluating possible sets of districts according to how well they meet agreed-upon redistricting criteria, and there are mathematical models which may be used in the redistricting process.

A major concern of geographers has been with the delineation or analysis of regions — the classification of territory. The easiest regions to analyze have been political — nations and their internal subdivisions, states or provinces. National borders are typically marked or defended, and more local political jurisdictions delimit the territories subject to differential property demarcation and taxation. These political subdivisions define loyalties and thus take on a permanent, almost a "sacred" character. They change infrequently and often with great difficulty.

A more ephemeral form of political region is the electoral district. Until this century they did not differ from the political subdivisions. Each English borough was entitled to two seats in the Commons. Nevertheless, the English and Scandinavian idea that *representation* was *territorial* and not strictly by who you were is a key concept. After all, representation could be just by social position, or as easily based on an interest group

membership, such as occupation. The idea that the representative from that territory should *live* in that area is particularly American. British members of Parliament need not reside in their constituencies and many do not, nor do many parliamentarians in France, Italy, the U.S.S.R., and many other countries.

A few definitions may be appropriate here. *Reapportionment* means the process and result of allocating electoral seats to territories, for example, the allocation of congressional seats to states. It is often used interchangeably — but imprecisely — with *redistricting*, by which we mean the defining and redefining of territorial districts, from congressional or parliamentary districts at a national scale to school, city council, or fire districts at the local scale. *Malapportionment* refers to inequality in the population size of districts, while *gerrymandering* refers to the manipulation of the boundary and composition of districts for some partisan purpose.

Complaints against gross inequality of population were already being lodged in 18th century Britain against the "rotten" boroughs, whose seats were sold to the highest bidder. In the United States Constitution of 1787, specific provision was made for seats of the House of Representatives to be allocated to states on the basis of population, with slaves equal to $^3/_5$ of persons. It was presumed that the internal districting of seats would respect a sense of equality, although this was left to state discretion. Thus since 1800 in the U.S., and after the Reform Act of 1820 in Britain, there has been a need to define electoral districts.

In the rapidly growing and changing U.S., but also in many other countries, population distribution shifts so dramatically over time as to demand, if not require, alteration in the structure of districts. The very purpose of the decennial census in the U.S. was in fact to determine the proper allocation of seats among states; the same principle was incorporated into state constitutions. Until fairly recently, in most states electoral districts were defined as sets of existing political subdivisions. Only the composition of constituent units of the districts changed over time.

Region and Regionalization

Virtually all physical and social processes — from plate tectonics to agriculture, sport, religion, or war — are inescapably territorial. They take place in, transform, or are transformed by the space where they occur. Geography is the science which seeks to understand how the surface of the earth is defined by or structured by these processes, but also how the very fact of space influences the processes and their outcomes. What is exciting, what justifies the existence of the discipline, what inspires our basic research is the simple idea that all these processes require space, leading to some commonality or predictability in their operation and in the patterns they produce.

The operation of all these processes is expressed geographically as a pattern of locations of activities of varying extent, size, and intensity and of interaction or movement of phenomena. All this is incredibly complex, and our state of knowledge is very primitive, despite years of exploration, description and analysis. To begin to bring some order out of this complexity, we try to recognize a simplifying structure of regions — a taxonomy of the earth's surface.

The operation of many processes leads to a differentiation of land uses into many types; other processes define a single region. For example, competition of social groups in a city leads to a pattern of ethnic and class housing regions; the distance-decay of pollution from a point source defines an impact region. The most obvious

regional structure results from physical processes — systems of geomorphological units, such as river basins and mountain regions, and associations of different climates, floral, and faunal regimes.

From a human point of view, there are perhaps four closely interrelated structures of regions — political, cultural, land use, and market. Of these, political regions are most familiar and tangible, since they are legally defined. At a national scale, these result from competition for territory and resources. Political regions reflect, however imperfectly, a parallel evolution of social and cultural groups and territories, defined by such attributes as language, religion, or a common political-economic history in an accustomed territory. This complex structure of cultural differentiation is similarly a consequence of long periods of competition of people for territory, and is a beautiful example of the interrelation of two geographic phenomena or processes. On the one hand, it is the simple fact of spatial separation, of isolated environmental development, that gives rise to differentiation — of physiology, of language, of predominant economies, of customs — in short of almost everything which both enriches and differentiates humanity. On the other hand is the fact of conflict over territory, of the differential growth of peoples, of their differential aggressiveness and technical capacity that lead, through diffusion, migration, and war to the spread of genetic traits, technology, the rise of civilization, and the intermixture of peoples and ways of life.

Within the larger political-cultural units called nations, three related economic-geographic processes combine to define an internal regional economic structure. On the one hand, there is an economic tendency to try to escape our territoriality. There are advantages of concentrating as many people and as much economic activity as possible in one place and producing at as large a scale as possible. These are termed economies of agglomeration and returns to scale. The larger the number of people at one point, the greater and richer the market. But the resulting city must be supplied by food and other resources that require vast space. Competition for access to the city, combined with variations in physical endowment, results ideally in a logical ordering or specialization of land uses and density of development grading from the most intensive near the city to least intensive on the periphery. Within the city itself, competition for access to the employment and commercial core, in combination with social group and individual goals of maintaining and improving status, results in a similar ordering and segregation of land uses, social groups, and intensity of development. Such competitive processes, defining territory in relation to a central point, tend to produce regions of homogeneous character.

On the other hand, the market and its hinterland, focused on one city, produces in fact a whole complex of cities. Because of the sheer size of the national territory needed to produce food and other resources, one city cannot efficiently supply all demanded goods and services. Competing markets (cities) arise and prosper, simply because the increasing cost and time of transportation outweigh the economies of agglomeration and scale. This is possible at smaller scales for frequently needed goods and services, like groceries, but only at large scales for those less frequently demanded, like specialist hospitals, giving rise to a complex hierarchical structure of centers and hinterlands from the largest metropolis to the tiniest hamlets. This competitive process results in *nodal* territories or regions, characterized by a core and periphery.

The notion of core and periphery is meaningful in a third kind of economic regionalization. Most nations, in the process of economic development, grow very unevenly. Initial investment is most profitable in a favored area. Development, in the sense of urbanization and industrialization, spreads gradually from this core, so that at one point in time the nation may be characterized by a wealthier, growing core and a

lagging, underdeveloped periphery. However, the initial advantages of centrality *can* become later costs of obsolescence, shifting the impetus of growth to the periphery, as seems to be occurring in the United States today.

A nation will have, then, a complex, interacting composite of nodal economic regions (Nashville and its trade area) and relatively homogeneous land use regions (a forest biome) and social-cultural regions (a racial ghetto). Imposed upon these informal, *de facto* regions is a structured set of *de jure* political regions. Major political regions, like states, are now or once were related to underlying economic, social, or cultural regions, which may have changed.

The important message is that these regions are *real* and *meaningful*. Citizens perceive that they are in the Philadelphia or Salt Lake City metropolitan region; that they are suburban middle class, white collar white residents; and that they are in Pennsylvania or Utah. All of these memberships elicit some sense of identity and allegiance. These regions derive their meaning from their functional roles, as the territories within which important economic, social or political processes operate.

Regionalization refers to the academic or practical partitioning of territories. A major activity of geography is to define regional structures, whether trade areas, land use patterns, cultural regions, or poverty areas. Although the underlying purpose may be to understand how human and physical processes define the landscape, the exercise often has great utility. For example, in the United States we define the system of State Economic Areas (fairly homogeneous); the very important system of Business Economic Areas (labor markets or trade areas, used for many federal programs); the system of metropolitan areas; regional or urban (re)development areas; health service areas; school districts; flood, fire or earthquake hazard zones; wildlife habitats; areas impacted by a proposed development — and dozens of others. Their recognition and definition is important because regional problems and needs differ as do appropriate applications of public action or regulation.

Modern geographic training places great stress on the techniques of regionalization, including the use of appropriate methods, the recognition of information requirements, understanding the way processes in question operate to define a region, and appreciation of the needs, perceptions and desires of the population involved. Because geographers are trained to see the relation between processes and regional structure, they cannot help but observe the inadequacies in so many regionalizations used in planning. One of the most valuable present and potential roles of the geographer is to measure these mismatches and try to estimate their economic and social costs. Political redistricting is one such form of regionalization, and one that deserves to be undertaken more sensitively.

Societies are dynamic, and regional structures are continually changing. Nations are formed; some grow territorially, some are absorbed. Regional economies prosper or decline and change in character. Growth in population and improvement in technology, especially in the quality and speed of transportation, place great stress on existing regional patterns and transform them. Agricultural land becomes urban as the metropolis expands. One city's trade area contracts as another grows. All such changes are stressful, as revealed in the endless and continual conflicts and concerns over land use change or over rates and magnitudes of regional growth and decline.

Despite stress, conflict, and difficulties of measurement, we can identify, indeed legally define, changing economic and social regions — growing or new metropolitan areas, expanded racial enclaves or altered poverty areas. Traditional political entities like states, counties, or even cities, however, have developed such a sense of identity and collectivity, such an accumulated "baggage" of procedure and custom, that

change is extraordinarily difficult. Where function obviously crosses state lines, as in the Philadelphia and New York commuter-sheds within New Jersey, complicated interstate agencies must be created. Population redistribution inevitably alters the apportionment of representation among and within states. Change in political districts must occur. As we shall see, even in these "temporary, administrative" entities, change is difficult and painful.

Political Regions

A complex and interrelated set of processes has led to the social structure of nations — territories within which a people expect security and in exchange give allegiance. Most nations have historically occupied substantial territory, for the simple reason that security involved control over enough land to provide food, water, other resources, and depth for defense. Most nations also have found it necessary and efficient to recognize constituent provinces or impose a sub-national territorial structure of administrative regions. There are several reasons why this is true across the spectrum from totalitarian to near-anarchic societies. First, one center was physically unable to exercise daily, continuous power over distant parts of the nation and was forced to delegate responsibility to local persons and areas. Second, many public functions related to a local territory, such as urban road maintenance, police, and fire services, were more efficiently executed and administered locally. Finally, separation and partial isolation, perhaps under widely varying environmental conditions, led to differentiation of regional economies, land use, and social structure. These differing interests demanded somewhat autonomous regulation and administration.

The evolution of the system of sub-national political units in any nation is complex and fascinating, reflecting a tension between and resolution of central goals of effective transmission of national interests and identity, and local goals of cultural preservation and regional development. The structure of political regions typically can be seen to have resulted from such factors as (a) underlying environmental conditions and subsequent economic patterns; (b) incorporation of formerly separate units in the process of national expansion; (c) the pattern of roads (or railroads) and forts established for national defense and integration; and (d) patterns of large-scale land ownership which developed in the feudal period (or in colonial or frontier settlements).

Territorial Representation

Even in the most authoritarian societies, rulers found it necessary to invite some formal representation from regions for reasons of mediating information and ensuring their loyalty and productivity (Birch 1971; Dixon 1968; Pitkin 1967; Pulsipher 1973). Those with power and a stake in national decisions were the ones who sought and obtained representation. In the pre-industrial period, those with the greatest power were the nobility, since it was control over agricultural land and people that permitted the accumulation of wealth. It was the nobles who could, through taxes, men, and food, sustain the very nation. These representatives were thus inherently territorial, persons often known by the name of their lands.

During the commercial and industrial revolution, the franchise and representation were gradually broadened to include others holding power or creating wealth: merchants and industrialists. Since commerce and industry occurred in cities and created

distinct urban territories, it was these legally-chartered, recognized cities that next acquired representation. Again, national rulers found it inescapable to grant representation in exchange for "loyalty and productivity," ultimately to avoid the risk of destruction of property or even revolution and secession.

Most nations, West or East, advanced or lesser-developed, inherited a regional structure and tradition of representation of historically-defined territories. Sub-national regions, provinces, states, or counties, were very real indeed, since they were simultaneously regions of administration, representation, and, often, cultural distinctiveness.

Simple representation on the basis of these traditional and meaningful units gradually departed from the ideal of their having an approximately equal stake in the nation. As the franchise was extended to all adult males, and as the population became more urban, imbalances of population in relation to "stake" and representation became marked, creating the problem of malapportionment.

To avoid riot, destruction, even secession or revolution, nations found it necessary to reform the scheme of representation. Many nations chose to maintain the concept of representation from traditional territories by means of *proportional representation* — a province receives seats in relation to its proportion of the national population. The U.S. Senate continues *pure representation* by territory. In Britain and most of its former colonies, however, even lower houses of national legislatures wished to maintain a tradition of the individual constituency. Eventually it became more and more difficult to utilize such traditional units as counties without creating too severe departures in population. In the United States the task was complicated by the constitutional requirement to reapportion seats among the states according to change in their relative population, thereby increasing or decreasing each state's seats. Finally, but not until the last fifteen years, the units of political representation in the United States had to break free from the traditional system of units of local political administration. The tradition of representation of unique territories has not been altered. However, the rapidity of recent population change and court-interpreted requirements for political redistricting have seriously undermined the historic attachment or identification of representation with local political units. We shall later come back to the question of whether this is good, bad, or indifferent.

The Redistricting Mandate

The United States Constitution provides for the allocation of representatives among states and guarantees that each state will have a representative system of government. State legislatures have the responsibility to devise schemes of districts for federal representatives as well as for their own legislative districts. The phrase "allocate among counties" (or units such as towns in New England) reveals the historical acceptance of the principle that all subdivisions deserve at least one representative. If a larger county were allocated more, these were either elected at large or by further political subdivision, such as townships and incorporated towns, and, within large cities, formal wards. More local sets of representatives (city councils, county boards of supervisors) are often elected at large, although in some states supervisor districting is an old tradition. In the largest cities, election of city councils was typically by wards. Reaction to the perceived evil of ward machine politics led to the substitution of at-large city council elections in some large cities during and since the Progressive era (1910-1924). At the same time there has occurred a gradual trend toward election rather than appointment of local boards and authorities.

In the United States, representatives are elected at several levels of government, but there is no simple hierarchy of districts, only complex and overlapping systems. U.S. senators and presidential electors are elected at large from states, U.S. representatives from congressional districts of about equal size (510,000 in 1980). Within states, senators and representatives are elected to legislatures from a structure of districts totally unrelated to the congressional districts. In some states, like Mississippi, even districts for senate and house are unrelated. Again, the structure of county council or supervisor districts is wholly independent of state legislative or congressional districts. Finally, city council or school districts are likely to overlap confusedly with all the preceding systems and with each other. The only example of nesting or hierarchy of governmental units in the United States are councils of government (COGS) which are not directly elected, but consist of members elected from constituent city, county, or special district agencies.

The "geographic" problem as such was historically not very profound or technical. Since population was not viewed as having to be very equal, there was a tendency to use simple existing boundaries of familiar legal territories, such as city limits, and merely group these in convenient ways. There was also a need to define voter precincts, the finest subdivision of districts. This was not always done on a clear basis of mutually-exclusive territory. Even in the 1970's, precincts in some Mississippi counties were places such as schools or fire stations, at any of which eligible citizens in the county could register and vote.

The geographic problem has become much more complex and technically difficult, if not profound, in recent years because of court requirements of precise population equality. Similar court requirements relate to treatment of racial minorities and concern with such matters as contiguity of territory and compact shape. The need for population equality has led to questioning the use of precincts as building blocks. Because they rarely coincide with census enumeration areas, adequate population data for them is lacking.

Many geographers and political scientists would probably agree that too great a reliance on technical, equal solutions has created a problem of unconcern or lack of identity with the districts. These problems now deserve greater attention.

The political-geographic problem, however, has always been important and interesting (Rae 1971). British and American governments have been organized on the basis of political parties, and each has sought to maintain or improve its territorial base. There have always been sectional conflicts — parts of the nation, parts of states, counties versus cities, cities versus countryside at all levels, classes and ethnic groups within cities — each seeking relative advantage from the structure of districts. Defining and later revising districts was exciting and important because it could truly alter the allocation of power, patronage, and the course of economic and social development. A hundred years ago this was the problem. Today, it's still an exciting one, although the freedom to draw primarily political solutions has been sharply curtailed by the imposition of the more technical geographic constraints.

The need for redistricting, as well as an appreciation for the pain and opportunity it creates, may be seen from two examples of the changes required on the basis of the 1980 census. For the United States as a whole, the number of representatives is fixed at 435. These must be reapportioned on the basis of population change (see page 64). The reallocation of 17 districts will be required, as shown in Figure 1, from the Northeast to the South and West. Obviously, those states losing seats will have a most difficult chore of redrawing boundaries. Similar shifts are required within most states, counties, and cities. For example, Washington State will gain an 8th congressional district, which

FIGURE 1 SHIFTS IN APPORTIONMENT OF CONGRESSIONAL SEATS AS A RESULT OF THE 1980 CENSUS

will force a major realignment of the existing set. In the Washington legislature with 49 districts, significant shifting must also occur, although not as drastic as that required in 1970. Population losses in Seattle will result in the painful reduction of districts in Seattle from eight to six. One of these will have to be incorporated into the growing suburbs and the other shifted to the more rapidly growing southwest part of the state. Although only two districts have to be shifted, the moves require a complex chain of adjustment.

We shall return to a more specific description of both the geographic and political-geographic problem, after briefly examining the history of redistricting and reviewing the criteria currently controlling the process.

2

Redistricting in the United States

Gross levels of malapportionment (unequal population per district) and degrees of gerrymandering (districts distorted for partisan benefit) were routinely criticized by reformers through the 19th and first half of the 20th centuries. When complaints were taken to court, they were routinely dismissed, as in the famous *Colgrove vs. Green* (1946), on the grounds that "political questions" were beyond the jurisdiction of the courts. Colgrove complained that his vote in a Chicago congressional district of 915,000 was worth only ⅛ of that of a person in a rural district with 112,000 people.

The urban, relatively liberal population had grown rapidly after 1900. Rural interests collaborated with urban business interests to maintain rural domination and political stability because of a fear of urban radicalism (Baker 1955). In a majority of states, constitutional provisions to redistrict were simply ignored for generations. In about one-third of states, all counties were entitled to one senator (the "Little Federal Plan") and at least one representative, irrespective of population. States employed various "non-population" factors to justify inequality, for example, the idea that each county deserves a representative, or that there was a limit to the reasonable areal size of a district a representative could serve (Dauer and Kelsey 1955).

Malapportionment

By 1960 the underrepresentation of urban and suburban areas had become extreme, and the Supreme Court had become more "activist" (Table 1). In a 1962 Tennessee case, *Baker vs. Carr*, the Supreme Court established the general principle of population equality among districts, holding that the apportionment of legislatures was a justiciable question on the basis of 14th Amendment protection of "equal representation." In a 1964 Georgia case, *Wesberry vs. Sanders*, dealing with a complaint that congressional districts varied between 824,000 and 272,000, the equality principle was applied to congressional districts, and the phrase "one-man, one-vote" was introduced. At first, equal population was not defined. An Alabama case, *Reynolds vs. Sims* (1964), is perhaps the classic decision, in which the court held that both houses of a state legislature must be apportioned on the basis of "substantially equal" population:

> *The Equal Protection Clause requires that the seats in both houses of a legislature must be apportioned on a population basis . . . it would seem*

> *reasonable that a majority of the people of a state could elect a majority of that state's legislators . . . diluting the weight of votes because of place of residence impairs basic constitutional rights under the 14th Amendment . . . as nearly equal population as is practicable . . . A state may legitimately desire to maintain the integrity of various political subdivisions insofar as possible and provide for compact districts of contiguous territory . . . so long as divergences from a strict population standard are based on legitimate considerations . . . citizens, not economic interests cast votes. People, not land or trees, vote. . .*

The use of county units as building blocks was disallowed in *Gray vs. Sanders* (Georgia, 1963). The "Little Federal" analogy, permitting all counties a seat, was struck down in 1964 in *Maryland Committee for Fair Representation vs. Tawes*. The measure of equality was gradually narrowed by 1969 to only one to two percent deviation for congressional districts *(Kirkpatrick vs. Preisler,* 1969).

The principle of one-man, one-vote was extended downward to county boards of supervisors or commissioners and city and town councils, in cases such as *Hadley vs. Junior College District* (1970), *Sailors vs. Board of Education* (1967) and *Avery vs. Midland County* (1968). At these lower levels of government, precise equality was neither required nor possible — population data are not sufficiently detailed.

The effects of these decisions is apparent from the figures shown in Table 1, indicating the minimum proportion of voters needed to elect a majority in a legislative house in 1962 (before reapportionment) and in 1968 (after the first round of reapportionment). Prior to reapportionment, eight percent of Nevada voters could control a majority of the state senate. The examples in Table 1 were typical, not extreme.

In the United States, inequality of population among electoral districts was a severe and continuing problem up to the mid-1960's. However, since the "reapportionment revolution" ushered in by *Baker vs. Carr*, it has taken remarkably little time to bring most American electoral districts at all levels into surprisingly equal population. Deviations are typically under ten percent, less than the amount of population change over a decade, and less than variation over a district in registration and voting rates. While the equal population criterion is overriding in the redistricting process, malapportionment is no longer a constitutional and social problem.

TABLE 1 MINIMUM PROPORTION OF THE POPULATION THAT COULD ELECT A MAJORITY OF A LEGISLATIVE HOUSE

	SENATE		HOUSE	
STATE	1962	1968	1962	1968
Alabama	25	48	26	48
California	11	49	45	49
Connecticut	33	48	12	44
Florida	12	50	12	50
Georgia	23	48	22	43
Illinois	29	50	40	49
Maryland	14	47	25	48
Michigan	29	52	44	51
Nevada	8	50	35	48
New York	41	49	33	49
Pennsylvania	33	50	38	47
Tennessee	27	49	29	47

Source: Taylor and Johnston 1979.

In many other countries, however, the one-man, one-vote principle has not been carried nearly so far, and differences in district size by a factor of several times still exist, justified usually by geographic criteria of remoteness or low density. This is perceived by some as an unsolved malapportionment problem, by others as reasonable flexibility.

Gerrymandering

Gerrymandering is the purposeful drawing of districts for partisan benefit. From U.S. legal history, it is clear that gerrymandering which manipulates racial minority voters is suspect. A state may impose its own constraints to inhibit gerrymandering generally, but the federal constitution does not offer any protection against manipulating districts for the benefit of political parties, individual incumbents, rural or urban interests, or religion and other non-racial interests (Bunge 1966; Clinton 1973; Dean 1892; Lossing 1972; Musgrove 1977; Sauer 1918).

The practice of gerrymandering began with the broadening of male suffrage in Britain in 1832, and in the U.S. and France after 1812, probably to protect the landed and propertied classes. It has since prevailed there and in other countries with single member constituencies (without proportional representation), since it is the parliament or legislature itself which is the "judge of the election of its own members." In many countries having proportional representation by party within large administrative units, such as Italy and the Scandinavian countries, there is little incentive to gerrymander.

The term "gerrymander" immortalizes Governor Elbridge Gerry of Massachusetts, who signed into law the Senate Redistricting Bill of 1812. This gerrymander was designed to maximize the election of Republican-Democrats over Federalists and succeeded brilliantly. Although Federalists won the most votes, Republican-Democrats took 29 of 40 seats. A district north of Boston which packed and thus wasted Federalist votes won immortality by a political cartoonist in the famous map (Figure 2) which gave rise to the term.

FIGURE 2 THE ORIGINAL GERRYMANDER (*Boston Gazette*, March 26, 1812)

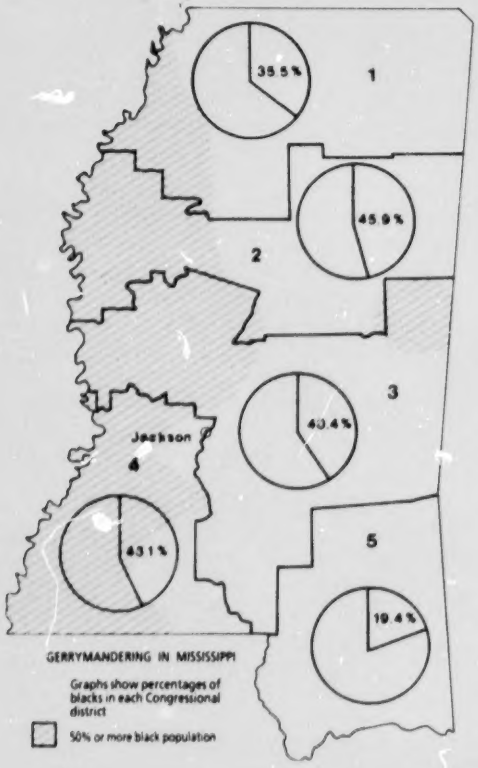

FIGURE 3 GERRYMANDERING OF CONGRESSIONAL SEATS IN MISSISSIPPI. As Mississippi Blacks became registered, Congressional districts were shifted from a north/south to east/west pattern, preventing any district from having a Black majority population.

There are countless examples of gerrymandering at every level in several countries. Figure 3 illustrates blatant gerrymandering to prevent the election of a Black Congressman from Mississippi. The Black population is concentrated in the west of the state along the Mississippi River, but the districts are drawn in an east-west pattern against the grain of transportation and land use to keep any district from having a Black majority. In Washington State, gerrymanders were attempted for the triple purpose of (a) maximizing Democratic strength by placing incumbent Republicans against each other and by packing and diluting Republican areas; (b) preserving particular Democratic incumbents; and (c) preserving urban districts in the face of declining population. In this plan it was necessary to use very elongated districts which in fact consist of noncontiguous and unrelated areas separated by unbridged bodies of water or unsettled mountain areas. One well-studied case of the effectiveness of gerrymandering is the historic Republican domination of the New York legislature despite strong statewide Democratic majorities (Lehne 1972; see also Hardy 1973 on California).

Given a substantial degree of partisan loyalty and/or block racial voting, gerrymandering has in fact been very effective in historically minimizing Black electability, particularly in the South, but also in the North. Gerrymandering has also been effective in preserving control by one party in the face of eroding and even minority popular support and in preserving rural or urban strength in the face of population shifts.

Racial Gerrymandering

Although equal population redistricting redressed the imbalance between rural and urban, or growing and declining parts of states or cities, it proved possible to gerrymander so as to diminish the likelihood of a racial minority, generally Black, being elected (Racial Gerrymander 1974; Engstrom 1976; O'Loughlin 1976). Another set of cases has addressed these questions. In a 1960 case, *Gomillion vs. Lightfoot*, the city of Tuskegee, Alabama, was enjoined from redrawing its boundaries to exclude Black voters. In *Wright vs. Rockefeller* (1964), the Supreme Court did permit a gerrymander, on the grounds that the complaint was a political not a racial question, thereby suggesting that race could be a criterion. *Fortson vs. Dorsey* (1965) and *Burns vs. Richardson* (1966) established the principle that a state (or local government) could not draw districts so as to "dilute" the possibility of a Black getting elected. The effect of these decisions was to outlaw gerrymandering which packed excess members of a minority into too safe a district or diluted the minority votes by dividing them into several districts with large minorities. Perhaps the major decision was *Beer vs. U.S.* (1975), which required comparison of a proposed or enacted plan with preceding and alternative plans in order to assess improvement in representation. *Richmond vs. U.S.* (1975) held that although a state must demonstrate a lack of discriminatory intent, it was not necessary to "maximize Black representation." However, in *Washington vs. Davis* (1976), the Supreme Court held that a discriminatory purpose would not have to be *expressed* but could be *inferred* from results.

The views of the courts concerning permissible and impermissible racial dilution is both complex and inconsistent (Van Knapp 1976). Both gerrymandering and the practice of electing several representatives at large from multi-member districts have been attacked. There is consensus on the point that the question of the dilution of racial or linguistic minorities, known as the problem of "representational equity," is justiciable — *Wright vs. Rockefeller* (1964) and *White vs. Regester* (1973). However, political gerrymandering is not justiciable *(Dunn vs. Oklahoma*, 1972) nor is religious dilution *(United Jewish Organization of Williamsburg vs. Carey*, 1977).

If complaints are brought under provision of the Voting Rights Act of 1965, then a greater burden is placed on defendants to show that there was not the intention or effect to dilute Black representation *(Beer vs. U.S.*, 1975; Bonapfel 1976). The Voting Rights Act (amended in 1973) identified areas, mainly in the South, with a history of racial voting discrimination, provided for federal voting registrars, and required all redistricting plans to be cleared by the U.S. Department of Justice. However, the burden is placed on the plaintiff to prove intention and unfairness. Racial minorities have a legitimate interest in a chance at fair representation, but no fundamental right to representation, especially proportional representation *(Taylor vs. McKeithen*, 1974). However, the Taylor decision did indicate that redistricting could be "color-conscious" with respect to a choice among alternative plans (Jones 1976; Latimer 1979; Smith 1975).

In several major cases the courts indicated that intentional racial gerrymandering would be unconstitutional but that the plaintiffs had not proven their case: *Burns vs.*

Richardson (1966), *Whitcomb vs. Chavis* (1971), *Fortson vs. Dorsey* (1965), *Gaffney vs. Cummings* (1973), and *Howard vs. Adams County* (1972). In several other cases, plans were ruled unconstitutional for reasons of racial dilution: *Stewart vs. Waller* (Mississippi, 1975), *Kirksey vs. Board of Supervisors* (Mississippi, 1977), *Robinson vs. Commissioners of Anderson County, Texas* (1974), and *Sims vs. Baggett* (1965). *Moore vs. Leflore County Supervisors, Mississippi* (1972), involved unconstitutional dilution because of intentional creation of non-compact districts which unnecessarily violated city boundaries and failed to consider natural boundaries or "equality of functions." *Connor vs. Finch* (1977) also condemned non-compactness, but *Ince vs. Rockefeller* (1968) declared there was no constitutional right to compactness.

Single member districts were suggested as "preferable" to multi-member, especially if the courts redistrict (*Conner vs. Johnson*, 1971), but many multi-member plans have been upheld, despite an effect of reducing Black representation, as in *Whitcomb vs. Chavis* (1971). Multi-member plans were declared invalid in *Kelverton vs. Diggers* (1974), *Wallace vs. House* (1975), *Zimmer vs. McKeithen* (1973), and *White vs. Regester* (1973). In *Graves vs. Barnes* (1972), a District Court ruled against arbitrary combinations of single and multi-member districts.

A few later cases added certain refinements. For example, in *Kirkpatrick vs. Preisler* (1969) the court ruled on how far a state could go in justifying deviations from population equality. It rejected a Missouri congressional district plan as having excessive deviation (3%!), although justified on the basis of integrity of county lines, compactness, military areas (arbitrarily applied), economic or other interests (irrelevant), and probable population shifts (also arbitrarily applied). The court, however, did not agree that the plan was unconstitutional because of any systematic, politically partisan gerrymander.

On the other hand, in *Mahan vs. Howell* (1973) the court accepted a deviation of 16 percent between the largest and smallest senatorial district in Virginia. In a Connecticut case (*Gaffney vs. Cummings*, 1973), the court ruled that not only were political gerrymanders not unconstitutional but that if done fairly, to provide balance, were actually commendable.

Likewise, in *United Jewish Organizations of Williamsburg vs. Carey* (1977) it was held that Jewish ethnicity and religion was no basis for protection under the 14th Amendment. This left intact at the U.S. Supreme Court level just two bases for complaint against a districting plan: unequal population and racial dilution. Gerrymandering which has the effect of benefiting one political party over another or of diluting interest groups other than racial or linguistic minorities is not unconstitutional, because there is no special right, other than citizenship, to representation *because* of identification with that party or interest (Washington 1971). Reformers consider this hiatus as unacceptable and urge the enactment of state constitutional provisions against gerrymandering.

Gerrymandering Techniques

We summarize some gerrymandering techniques in Figure 4. Each case simplifies reality by assuming a uniform distribution of Republicans and Democrats in exclusive areas. Figure 4A illustrates that if there is strong minority concentration of one party or race, here Democrats in the city, it may be easy to dilute its voting power by splitting, even without much shape distortion. Figure 4B illustrates districts which combine rural and urban territory to maximize rural control. Although the city has a majority of the

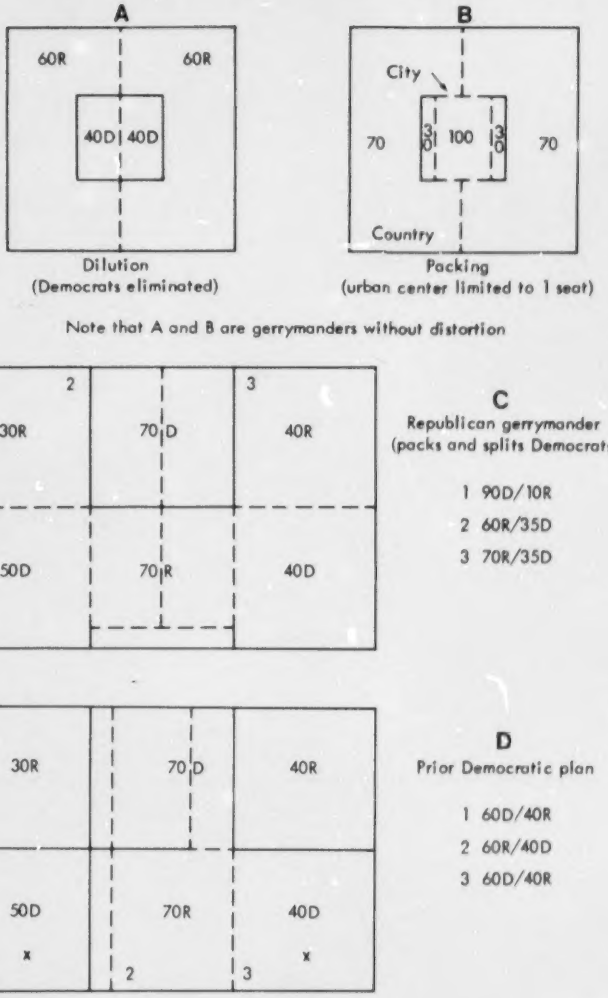

FIGURE 4 GERRYMANDERING TECHNIQUES

population, it can be reduced to one of three seats by means of packing and dividing. Figure 4C illustrates the most common form of gerrymandering, stringing territory together with the combined methods of packing and splintering. In the example Democrats have a majority of 160 of 300 but can be limited to one seat in which they have a wasted majority of 90/100; the other 70 are split among two districts in which they are rendered the minority (Fisher 1973). Figure 4D illustrates what might have been an earlier configuration, in which Democrats had two safe seats and Republicans one. Note that after the gerrymander, Republican goals are aided by placing two Democratic incumbents (**X**) against each other.

Measures of Gerrymandering

While malapportionment (inequality of population) is easy to measure and evaluate, gerrymandering is more difficult to measure and prove. A measure of compactness (versus irregularity) may suggest the absence of gerrymandering, but it does not constitute proof, since it is possible to gerrymander compactly. In the case of racial gerrymandering, the test of a gerrymander is to compare the proportion of seats held or likely to be won by a minority to its proportion of the population or to the proportion likely to be won under a model plan prepared by the minority. Whether suspect districts could have been avoided is an additional test. Evidence of gerrymandering includes possible dilution (40-50 percent) and packing (over 70 percent).

The test of partisan political gerrymandering is similar, comparing the proportion of seats won, or likely to be won, with the proportion of overall votes for the party. The difference may be called the *electoral bias*. In Figure 4C, Democrats have 60% of the vote but 33% of the seats — a *minus* 27% "misrepresentation" bias.

Electoral bias is not really proof of gerrymandering. It is almost a necessary consequence of single member constituencies, where a small shift in partisan opinion among nearly equal parties can drastically change the balance of seats. The congressional districts of Iowa are a fascinating case in which Republicans risked a six district gerrymander to give them small majorities in all. A sharp shift of opinion led to a dramatic but temporary Democratic victory (5 to 1)! We can measure the effect of gerrymandering on past elections, but it is more difficult to evaluate hypothetical plans since, in fact, voting proportions are not constant. For example, in Figure 4C the pre-existing Democratic scheme normally assured two seats, but if there were a temporary overall swing of ten percent, then the Republicans could take all three seats, although the democratic vote was still 44%. Maximizing one's seats through the use of "marginally safe" districts risks massive losses through voter swings.

3

Criteria for Redistricting

We may distinguish between criteria which are constitutionally required — equality of population and representational equity — and other political and geographical criteria which may be permitted or advocated (Table 2; Baker 1968; National Municipal League 1969). The two essential criteria are both based on the 14th Amendment to the U.S. Constitution, which reads:

> *No state shall . . . deny to any person within its jurisdiction the equal protection of the laws. . .*

The first criterion is to overcome malapportionment, while the second is aimed at preventing gerrymandering. It may be used in an affirmative way, purposefully to aid minority representation. Two criteria are essentially geographic and discourage gerrymandering: to form compact and contiguous districts and to respect as much as possible such communities of interest as ethnic or religious groups, social classes or urban or rural areas. Two criteria are both geographic and political: to represent political units as such, whatever their population, and to respect political boundaries, such as counties, cities, and school districts to the degree possible. Representation of political units existed earlier, but has essentially disappeared as a result of its incompatibility with the equal population requirement. However, the geographic criteria, compactness and community of interest, and the criterion to respect political boundaries in drawing districts, do appear in some state constitutions or city and county charters. They are usually included in a court review of redistricting plans or in a redistricting actually undertaken by a court as a defense against gerrymandering.

Political criteria are significant, although it is unlikely that they will be legally enshrined. One is to minimize the degree of change in a pre-existing pattern of districts. A second is to maximize the potential effectiveness of voting by creating as many marginal or swing districts as possible, to minimize packing or wasted votes generally, not just those of racial minorities. Alternatively, it is politically important to provide for "reasonable stability" through a compromise of both "safe" and "swing" seats.

Constitutional Criteria

Equality of Population

Although the constitution has not changed, the enforcement or recognition of equality of population has only occurred since *Baker vs. Carr* (1962). What is *equal*

varies in court interpretation by level of governmental unit and whether a plan is statutory or court-ordered (Table 3). In general, deviations greater than the minimum one to five percent must be justified by local circumstances (data problems, integrity of county lines, shape, or racial distributions). The greater latitude for smaller districts is presumably due to the indivisibility or lack of population data for areas smaller than census enumeration districts. In *Gaffney vs. Cummings* (1973), the court also raised the question of the census undercount and inaccuracy as a reason to justify deviations.

Where enumeration districts have about 2,000 persons, it is clear that to achieve a one or two percent deviation for legislative districts of 25,000 (+ or − 500) is probably not possible (a 4% margin is needed). Naturally, the more strictly the population equality criterion is interpreted, the more difficult it is to meet other desirable criteria such as respecting city or county boundaries or compactness.

The measure of equal representation is based on simple population, not whether people are citizens or aliens, military or civilians, or registered to vote or not. Those areas with high proportions of children or non-voting military or college populations may have much more representation per voting adult than areas with few children or no military personnel. A few states do exclude military in group quarters from the apportionment population. In *Davis vs. Mann* (1964), exclusion of military personnel was disallowed, but if the exclusion is specified in a state constitution, as in Virginia and Washington, it may be allowed *(WMCA vs. Lomenzo,* 1965). Population estimates are generally disallowed for redistricting purposes because of sampling uncertainty, although in *Kirkpatrick vs. Preisler* (1969) the Supreme Court said that "where population shifts can be predicted with a high degree of accuracy, states that are redistricting may properly consider them." Use of registered voters has but rarely been accepted, as in *Burns vs. Richardson* (Hawaii, 1964), and only if it can be shown that the distribution would not be substantially different from a plan based on total population.

Measures of population equality or deviations from equality. Courts employ and prefer the simplest measure — the simple percent deviation from the hypothetical average district population. Since this merely gives the range, in comparing various plans account should be be taken of the *mean deviation* (above, below, and overall). Thus a plan with a very low mean deviation might allow a slightly higher range than another plan with a higher mean deviation.

TABLE 2 CRITERIA FOR REDISTRICTING

Constitutional Criteria
1. Equality of Population
2. Equal probability of representation: racial equality

Geographic Criteria
3. Compactness and contiguity
4. Integrity of communities of interest

Political-Geographic Criteria
5. Representation of political units
6. Integrity of political boundaries

Political Criteria
7. Altering the system as little as possible
8. Political gerrymandering: partisan and bi-partisan; balance of safe and competitive districts; responsiveness

TABLE 3 MAXIMUM DEVIATIONS FROM AVERAGE POPULATION (percentage)

	STATUTORY	COURT-ORDERED
Congressional districts (or very large legislative districts)	2-4	1-2
Legislative districts (or large city or county districts)	5-10	2-5
Local districts (supervisor, school, commissioner)	5-15	4-10

Banzhaf (1965) has argued that because of the binary nature of political decisions (yes, no; Democratic versus Republican; winner or loser) all voters don't have an equal chance of affecting the outcome, and that the difference in effective voting power is best measured by the square root of the deviation — that is, a deviation of 16% is only twice as "bad or effective" as a deviation of four percent. The courts have so far rejected the argument, mainly on grounds that most voters are not so predictable or without choice.

When evaluating formerly more severe malapportionment, political scientists use such measures as the ratio of the largest to the smallest district, the minimum proportion of the population that could elect a majority of the body, the Lorenz curve, and the associated GINI coefficient of concentration. The Lorenz curve plots the accumulated proportion of population against the accumulated proportion of districts. The GINI coefficient measures the degree of inequality. However, these are less useful for evaluating the smaller degree of deviations currently encountered but may be very useful for measuring *political* imbalance.

Equal population has not been required for all kinds of elections. Councils of government (regional authorities), even those with taxing powers, may have representation by constituent political units (Council of State Goverments 1972). Similarly, in water, irrigation, and other special districts, where the paying and benefiting units are properties, voting may be weighted by property value *(Salyer Land Co. vs. Tulare Lake Basin Water District,* 1974; Gartoon 1975; Martin 1973, 1975).

Evaluation of the population equality criterion. The recent tendency of courts to accept modest deviations — up to 16 percent for legislative districts — would probably be considered reasonable by geographers and political scientists if this flexibility is used to maintain the integrity of political units and communities of interest. It is also considered justifiable by population specialists, because of the inherent uncertainty of census returns, the high mobility of the American population, and the great variation in the proportion of population eligible to vote. Smaller districts would be more justifiable in areas with few children, or which are expected to grow quickly.

Equal Probability of Representation

Although many groups have sought protection, only racial or linguistic (Spanish speaking) minorities have received it. The problem, as recognized in *Beer vs. US* (1975) and also in *Burns vs. Richardson* (1966) and *Fortson vs. Dorsey* (1965), is that even if populations of districts are equal, and even if the districts are compact, a racial

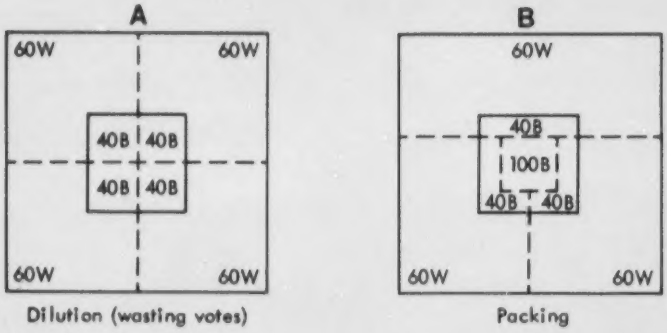

FIGURE 5 RACIAL GERRYMANDERING

minority can be discriminated against and its votes rendered relatively ineffective through either of two devices or both: *packing* and *diluting*. These are illustrated in Figure 5. In the dilution case, the minority has 40 percent of the area's population (more than enough for a seat), but is so splintered as to be unable to elect any representatives. An example of how this worked is the former set of Mississippi congressional districts cited previously (Figure 3).

In the packing case (Figure 5), the minority has 55% of the population, deserving a chance at two seats, but representation is confined to one by packing an unnecessarily large number and proportion of voters in one district, and splintering the remainder. This was the situation in both the Chicago and New York ghettos, which long elected one very secure congressman when two or three might have been possible.

An alternate form of dilution where there is a large Black minority is to elect all seats at large. This has sometimes been disallowed where it has had the historical effect of preventing participation or representation which might reasonably have been expected, for example in Atlanta and many other southern cities and counties.

This raises the question of what constitutes a "reasonable chance of election" for a minority, and the issue of "affirmative gerrymandering" (Wells 1978). Because of a high proportion of children, and lower levels of registration, it is widely held that somewhere between 55 and 65% of the population of a district must be Black in order for a Black to have a reasonable chance of election. Proportions over 70% are wasted. Thus districts with 51 or 52% Black population might look favorable, but would be suspect in court as dilution because a 52% Black population may mean only a 40-45% Black voting population. On the other hand, a minority of 25 to 40% in areas where it is not possible to form majority districts has been shown to constitute a "blocking quarter," a voting strength which forces a majority incumbent to take into account the needs of the minority in order to survive a primary election. In a redistricting plan involving a sizeable minority, a reasonably good chance of representation may be achieved by:

(1) A maximum number of districts where Blacks are 55 to 70 percent or under 20 percent;
(2) Minimum number of seats where Blacks are over 70 percent or between 40 and 55 percent;
(3) Districts with 20 to 40 percent Blacks are acceptable.

But is affirmative racial gerrymandering also unfair, disenfranchising the White majority? Indeed, in *Taylor vs. McKeithen* (1974) the court stated that it was not proper to try to maximize the number of Blacks elected, only to give them a reasonable chance at election. On reflection, however, it is seen that much of a minority will be in districts with a small minority population. Thus it is virtually impossible to achieve minority representation greater than ⅔ to ¾ of their proportion of the population. In any event, the usual measure of racial dilution is to compare the proportion of minority representatives to their proportion of the population (Washington 1971).

Geographic Criteria

Compactness and Contiguity

Many statisticians and geographers as well as critics and reformers of electoral abuse have stressed compactness both as inherently desirable and as a defense against gerrymandering (Roeck 1961; Schwartzberg 1966). It has therefore become a major criterion for evaluating districting plans. Although in *Reynolds vs. Sims* (1964) and in other cases the courts have said that a state may legitimately impose a compactness and contiguity requirement, discontiguity or irregularity of shape are constitutionally suspect only if they are used to dilute the effective representation of a racial or linguistic minority. For example, in the recent conclusion (1980) of a long-standing Mississippi case, *Connor vs. Finch* (1977), the court relied on analyses of the number of "non-compact" districts, and the justification for each irregularity (Chapter 6).

Many state constitutions require "compactness and contiguity." In typical cases which reach federal court, the respective sides will base complaints and defenses on grounds of violation of or respect for compactness guidelines. In the case of the redistricting of Washington, for example, compactness was suggested by the plaintiff as a criterion and accepted by the federal court (*Prince vs. Kramer*, 1972). It should be stressed that the legal argument for compactness is on grounds of "equal representation" for racial minority voters, not because of any other possible interest, political party, religion, or social or economic class.

A compactness criterion is not necessarily a guarantee against gerrymandering for racial or partisan political purpose. It is theoretically possible to gerrymander while maintaining compact districts. Political scientists (Dixon 1968: 458, 522-534; Nagel 1965) and geographers (Taylor and Johnston 1979) have attacked the "myth of compactness." They have shown that intentional compact gerrymandering is possible and that unintentional gerrymandering might occur even with supposed "non-partisan" application of compactness criteria. For example, if a Black area were quite compact and regular, it could be split among White majority districts while maintaining a pleasing compactness. This is why a separate test of racial dilution is needed. Compactness is not a sufficient guarantee.

This argument is not very convincing. Except in isolated instances, it is quite difficult to gerrymander compactly. In most plans, the consistent operation of a compactness criterion will have a random effect on political partisanship. The distribution of districts will show about as many seats that are relatively safe for each party or race as marginal between them. If one party or race were markedly more segregated than another, then a compactness criterion might tend toward excessive packing of that group. In reality Whites are at least as segregated from Blacks as vice versa, and "conservative" from "liberal" populations, even if Blacks or liberals live in denser areas.

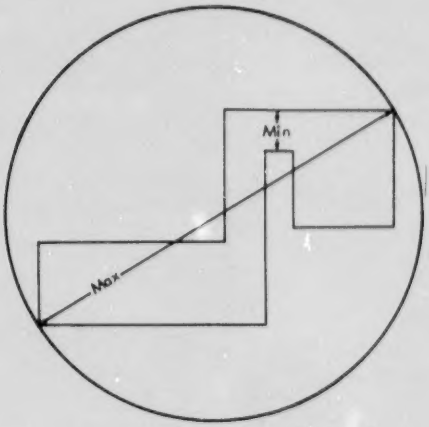

FIGURE 6 COMPACTNESS MEASURES. Among compactness measures would be (a) Max/Min diameter ratio (here, 10:1); (b) ratio of perimeter of district to circumference of circle of equivalent area (here, 1.9); and (c) ratio of district area to area of circumscribed circle (here, 0.27).

The measure of compactness. Assuming that a compactness criterion is invoked, how should it be measured? Bunge (1966) suggests that the circle is the ideal shape against which gerrymandering can be tested. Schwartzberg (1966) proposed several indices of compactness (Figure 6):

(1) A ratio of the perimeter of a district to the circumference of a circle of equal area; which will have a minimum value of 1, increasing as the district becomes more irregular. He suggests that values over 1.67 are "irregular."
(2) The ratio of the maximum to the minimum diameter (square districts, more reasonably related to layout of administrative units in many regions, are as compact as circular areas).
(3) The ratio of the area of the district to the area of a "circumscribed circle" (circle defined by the maximum diameter).
(4) The moment of inertia, or the variance of distances from the centroid of the area to the boundary.

All but the second are difficult to compute, and probably not worthwhile. The second measure is adequate and simple to grasp. Generally, justification should be provided for districts for which the ratio exceeds 2.

A too simplistic application of such geometric compactness measures is foolish, especially where the distribution of population is irregular within districts. In many regions, the population is uneven, perhaps strung out along roads or railroads. Travel may be easier and cheaper in some directions than in others, such that an elongated district astride a major transport corridor might in fact be the most compact in the sense of minimum travel time for a representative to travel around the district. If so, then a modified criterion, the ratio of the maximum to the minimum travel time, would be a preferred measure. If a distance-minimizing computer algorithm is used to generate

districts, compactness is achieved by definition (Chapter 5). One problem with such computer solutions is that they elevate compactness to too high a priority. Many statisticians or programmers exaggerate the value of compactness. Geographers should be aware that the physical shape of a meaningful territory is of far less importance than its behavioral shape or sense of integrity.

Integrity of Communities of Interest

The last decade of ever greater emphasis on numerical equality has also tended to be one of concentration on population statistics and computer manipulation. Traditional ideas of intense voter identification with electoral districts have eroded. Electoral districts are viewed more and more as changeable, convenient vessels for the execution of elections than as units possessing a collective sense of stake. Meaning is being stripped from these territories, as they are laid out or changed without regard to traditional areas with which people identify. Geographers should argue strenuously against dehumanization of political districts, not out of nostalgia or of resistance to equality, but because they know how important a sense of community is to participation and a sense of well-being.

Citizens vote, in part, according to their identification with various interests, for example, religious values, occupation, class, or rural or urban orientation. There is a strong basis in arguing that "effective representation" or influence on the outcome is enhanced by grouping of like interests together (Polsby 1971: 270-273). This is constitutionally required only with respect to race. The geographer will also observe that districts which correspond somewhat to nodal regions, a core urban area and its economic or cultural hinterland united by transport and communications, will have a greater sense of unity, awareness of common problems, and, perhaps, participation than districts which arbitrarily combine disparate areas and ignore patterns of regional identity and loyalty. The criterion of following administrative boundaries does, of course, tend to support a nodal region criterion to the extent that political units constitute unified regions.

Districting according to economic class or religion will tend to reinforce liberal versus conservative voting behavior and party allegiance, and result in fairly safe districts. On the other hand, districting according to nodal regions, at least in areas of smaller cities, will merge economic class and rural-urban interests, resulting in more balanced districts, leaning perhaps in a conservative direction.

Generally, the only "interest" groups which the U.S. courts will "protect" are racial or linguistic minorities (Black, Asian, Hispanic). Complaints by religious groups or economic classes have been dismissed. However, at a lower level of importance court evaluations may be influenced by arguments about districts which are so irregular or disparate as to affect the ability of a representative to communicate with constituents or of constituents to organize effectively. For example, a district may cross a mountain range or consist of distinct and separate parts. Unfortunately, neither nodal regions nor regions of homogeneous classes or other interests are likely to match the exact size of an electoral district.

The ability to follow "community interest" criteria is very much a matter of scale. In a metropolitan area broad ethnic, social, religious, or economic class divisions can be fairly readily taken into account, and often are, in partisan redistricting. In areas of small cities and rural countryside, a nodal structure corresponding as much as possible to political units is usually preferred for large (legislative) districts. For smaller districts, such as county supervisors, a separation of rural from urban districts would result in a greater perceived sense of quality of representation.

Despite the practical difficulty of delineating districts with both acceptable population equality and a degree of common interest, the attempt deserves greater effort than appears to have been the case in recent years. It is a far more important criterion with respect to a goal of raising the quality of representation than compactness. It justifies some departure from population equality, at least to the degree of population uncertainty, typical levels of change over a decade, and normal variations in the voter/population ratio. This deviation could be +/− 5 percent for large districts (over 100,000) and +/− 10 percent for smaller districts.

Political-Geographic Criteria

Representation of Political Units

Representation of a political unit as such, rather than just respecting political boundaries, has been disallowed for legislatures in the U.S. (*Maryland Committee for Fair Representation vs. Tawes*, 1964). The U.S. Senate is the obvious exception to this general rule.

States argue that counties are to states as states are to the nation — the "Little Federal" analogy — and that loyalty to counties and their historic persistence is a basis for representation, at least in one house of a legislature (McKay 1963). However, the argument was struck down on grounds that counties did not join together to form a state, but were mere administrative creations of the state and could be created and abolished, joined or divided at will. Thus, by successive division of declining rural counties, continuing rural domination could be assured, an urban majority notwithstanding.

On the other hand, once a structure of counties (or towns in New England) was firmly established, they have not changed. Many bodies, even state party central committees, consist of equal numbers of representatives per county. Thus there remains some small basis for representation of an upper state house on a political unit basis.

The question of whether sparsely settled remote rural areas deserve greater representation is a difficult one (Israel 1963; Perrin 1962). In *Reynolds vs. Sims* (1964), the U.S. Supreme Court said "no" on the grounds that modern communications made special treatment unnecessary. In contrast, the United Kingdom Boundary Commission must explicitly allow "geographical accessiblity" considerations to override population equality on the grounds that it is more difficult to serve or reasonably represent a dispersed constituency and that less dense areas may have a greater per capita share of certain kinds of problems (resource management, highway provision). There is no doubt that it is more difficult to communicate with a dispersed electorate. This accessibility factor perhaps justifies moderate departures from population equality, if such a deviation permits better fit to political units and communities of interest.

Weighted voting. One means to permit representation by political units and to avoid redistricting altogether, while in theory meeting equal population requirements, is for representatives of the units to exercise a weighted vote proportional to their population (Kelly 1971). This has been disallowed for legislatures (*WMCA vs. Lomenzo*, 1965).

In the United States, only New York State permits weighted voting for county boards of supervisors (as approved by the New York Supreme Court in *Iannuci vs. Board of Supervisors*, 1966). However, weighted voting has been criticized by political scientists on two somewhat contradictory grounds (Banzhaf 1965). On the one hand,

smaller areas have less voting power but will have equal time and exposure in debate and committee work and may therefore exercise a disproportionate influence. On the other hand, it may be that one large unit has a majority (or at least a dominant share) of county population. As in voting stock in corporations, a representative from such units has extraordinary power. One could argue that not only are the small areas rendered impotent, but the voters of the large unit, having only one representative, are not fully or fairly represented in their political or social diversity.

Integrity of Political Boundaries

Although it has proven impossible to reconcile the desire to use counties and cities as the unit of representation with the constitutional requirement for equal population, the geographer would support the political scientist in arguing that every attempt should be made to maintain the integrity of political units. In *Reynolds vs. Sims* (1964), and in other cases, the Supreme Court did recognize the desirability of following the boundaries of legal units of government and including them entirely within congressional and legislative districts to the extent practicable so long as substantially equal populations are achieved. In *Taylor vs. McKeithen* (1974) the court specifically noted that political units can come to "mean much" to voters over time and should not be disregarded. There are two compelling reasons. One is that registration and elections are organized by such political units, and voters identify with them. It is more convenient and less disruptive or confusing to respect these boundaries. The stronger reason is that use of political entities imposes a significant barrier to gerrymandering whether for racial or partisan political reasons, since it prevents stringing together precincts of a particular character out of disparate political units. In 1980, California voters adopted a proposition which made respecting the integrity of county and city boundary lines a state constitutional criterion for redistricting.

Another argument in favor of following political boundaries is that an elongated district crossing many political lines may tend to weaken *effective* representation, because of probable disorganization or disunity of the parts. A court may well include a test of integrity of political boundaries in evaluating redistricting plans by counting the numbers of divided counties or cities with populations smaller than one district and by requiring justification for each such split. Usually splits may be justified on grounds of the stricter requirement of population equality. Splits will be less suspect if there has been no attempt to disperse or concentrate a racial minority.

As a practical guide, it may be suggested that counties and cities smaller in population than a district should be divided only if it is unavoidable. Further, the geographer might well suggest that if a county or city has to be divided, then other aspects of community interest, such as race, religion, or class, should be respected. Again, as with geographic communities of interest, maintaining the integrity of political units should justify a moderate deviation from strict population equality.

Political Criteria

It is fascinating that many courts and reformist groups emphasize taking politics out of redistricting, while legislators in the process of redistricting emphasize political implications. The latter should not surprise us, since politics are what elections are all about. Any non-partisan, politically "blind" effort will have profoundly political results (Nagel 1965; Dixon 1968; Taylor and Johnston 1979; Elliott 1970).

Professional political scientists and geographers generally agree that it is not only impossible but even destructive to try to make redistricting non-political, a matter of geometry and equal numbers. This is not to justify either inequality or partisan gerrymandering, but to suggest that there are positive political criteria to be observed which will improve the quality of participation and representation.

Incumbent Gerrymandering

An obvious and important criterion used by legislators is to maximize the probability that they will be reelected. The immediate reaction is to say that this is ethically suspect, in the sense that everyone should play the same game fairly. On the other hand, most of us do not have to stand for frequent reelection. Manipulating districts to favor the incumbent does constrain the choice of the voter, yet the effective power of the typical voter is probably enhanced through greater experience and seniority of the long-term incumbent.

Looking at it from the point of view of the voter and the district, it is almost but not quite the same thing to minimize the degree of change in the pre-existing pattern of districts, that is, to alter as few districts as necessary. This does not require knowing the residential location of incumbents, some of whom might well be placed in another district as boundaries are adjusted. Minimal change could have clear benefits to a sense of continuity, participation, identity, and concern for the needs of the district. Does the positive benefit outweigh the reduction in choice from a tendency to shield incumbents, who have the added advantage of name familiarity?

From the point of view of a consultant drawing up plans for a legislative body, practical reasons for beginning with an existing plan and changing it as little as necessary are to improve the chances that it will be accepted by a legislature and to reduce the burden of change for local election machinery.

Political Gerrymandering

Political parties often have a bipartisan interest in "orderly change" or reasonable stability. From the point of view of political theory, it is obvious that if districts are balanced between political parties or other interests, the greater the effective power of voters in controlling the outcome, and *ceteris paribus* the more responsive the incumbent to all the major constituencies of the district. In the Washington redistricting case the court was asked by the plaintiff to include a criterion of maximizing the number of marginal or swing districts, but the court declined on the grounds that this was a political not an "equal protection or 14th Amendment" matter. Yet, logically, it seems quite reasonable to argue that persistently safe districts do effectively disenfranchise the minority. It has been stated by the court *(Taylor vs. McKeithen,* 1974) that in districts with a substantial minority, capable of shifting the seat in a major opinion swing, incumbents do vote in a manner responsive to minority as well as majority interests (Kuklinski 1977).

From the point of view of parties, however, maximization of marginal seats would be highly undesirable on the simple grounds of excessive turnover of personnel and consequent inexperience of office holders. After all, elected representatives do have a vital, complex, and continuing role learned over time.

Political parties are inclined toward a strategy which gives each party a core of safe seats, especially for the leadership, which will survive even a landslide for the other party. One-fourth to one-third of all seats would be safe for each party, with the remaining third of seats being marginal, and more likely to shift between parties.

According to this argument, even a major opinion swing will still leave a saving third or more of safe seats. The actual distribution of seats in Congress has averaged only around 18 percent marginal — 15 percent in the east and south, 25 percent in the midwest and 20 percent in the west (Buchanan 1977). A higher proportion of marginal seats would probably be preferred by special interest groups since it would tend to increase their leverage in influencing outcomes. According to some studies, bipartisan districting produces abnormally high proportions of safe seats, while non-partisan districting produces a bias in favor of the majority party by reinforcing the status quo. This discussion has assumed two parties of about equal strength. Where one party is dominant a partisan plan is likely to pack minority party votes to minimize their representation. However, a non-partisan plan might also wish to concentrate minority votes in order to assure them representation.

There is a great deal of argument over the consequences of non-partisan and computer districting. It has been my contention that such an approach will tend to yield a distribution approaching what parties like, one-third safe for each party and one-third swing, on the grounds that the probability of bias in favor of one or the other in each decision is a random event. Nagel (1972), Dixon (1968), and Taylor and Johnston (1979) believe there is no such thing as real non-partisan districting, and that any plan will result in bias, however unintentional. The risk of unintentional bias is in large part a function of relative concentrations of the parties. Any party with a few areas of total domination and broader areas of minority status will tend to be penalized in a "blind" districting over a party with extensive moderate domination. The only way to be sure of the effect of a plan is to have a series of elections, but estimates of the effect may be made by measuring the effects on the basis of votes in representative past elections. While the courts may consider this irrelevant, I agree with the critics that a consultant offering a non-partisan plan has an obligation to conduct just such an analysis, in order to be sure. In the 1972 Washington redistricting, the Democrats complained on appeal that they were discriminated against, but in fact they gained seats in the subsequent election.

Political Effects

Even in situations where political considerations are to be ignored or excluded, the redistricting process cannot escape political effects. It would be wise to evaluate plans politically, even if political criteria were not used in the plan design.

Where population change has not been drastic, it is both easiest and, I believe, theoretically justifiable to change the system of districts as little as possible. Stability helps to develop and maintain the sense of identity with districts — even if "political considerations" are officially excluded.

With respect to partisan effect, if the plan is purportedly non-partisan (or bi-partisan) then the consultant should evaluate and select a plan which grants both parties a set of reasonably safe seats, probably in proportion to their overall voting strength in the state. As to the balance between "safe" and "swing" seats, the dilemma is difficult. Maximizing the number of swing seats presumably enhances voter choice and responsiveness of representation but can also lead to instability. In the U.S., Britain, and other countries with single member districts, maximizing swing seats risks a massive electoral bias, a severe gap between the proportion of votes a party receives and the proportion of representatives elected. For example, in Washington State Democrats hold five of seven congressional seats, but received only 53 percent of the

statewide vote. A reasonable solution may be a plan with about half fairly safe seats (traditionally 60 percent majorities), one-quarter "marginally safe" (55 percent majority) and the remaining one-quarter "swing."

Electoral districts should not be viewed as mere conveniences of electoral machinery, but as units for effective representation. If so, the political criteria — integrity of political boundaries, changing a set of districts as little as possible, taking into account the political balance — and the geographic criterion of respecting communities of interest cannot and should not be excluded.

At-Large, Multi-Member, and Single-Member Districts

In several parliamentary democracies, for example Italy or Belgium, groups of representatives are chosen by proportional representation from fairly large administrative units according to total votes for parties. Some, like Germany, select half of the lower house (the Bundestag) by proportional representation by *lands* (states) and half in single-member districts. In the U.S., Britain, and France, among others, national representatives are elected from single-member districts. U.S. Senators are elected at large since they do represent states. U.S. state legislatures are all elected from districts, although in some states, like Washington, lower level representatives are elected, at large, from each upper house district. Even this has been disallowed in areas where this would tend to dilute the chance of a racial minority being represented *(Conner vs. Johnson,* 1971). Traditionally, in parts of the south, several legislators were elected at large from populous counties (like Fulton County, Georgia, containing Atlanta) with obvious intent to minimize Black representation (Bonapfel 1976).

At-large elections are still common for election of county supervisors, school boards, and city councils. One historic reason for this was racial, a second was reformist. The election of councils by district in large eastern cities came to be identified with the worst abuses of machine ward politics, and with the narrowest parochial interests being pursued rather than the common good. The Progressive reformers for "good government" (1910-1924) succeeded in shifting many cities to at-large, nonpartisan elections. While ardently defended on grounds that councillors should represent all the city, the system is criticized on at least two counts, the tendency for "elitist" representation (a preponderance of election of prominent persons from wealthier areas) and neglect of the special needs of parts of the city (including a fair share of service provision). Some cities have a compromise system of nomination by district, and then election at large.

There is no "right" answer to this dilemma. Rather, it is a matter for local decisions. If there is a political-geographic principle to guide us, it would be the quality of representation. For small cities, perhaps with under 50,000, or for very small rural counties, perhaps with under 5,000 people, voter-candidate-representative interaction should not be lost by at-large elections. However, in large jurisdictions, a sense of geographic or territorial diversity as well as complexity and impersonality of size suggests a preference for district elections.

4

Electoral Reform

Our discussion has principally concerned the districting of single member systems in which representatives are elected by plurality, the system which occurs in the U.S., Canada, Britain, and France. The majority of countries, however, have opted for various forms of proportional representation in multi-member districts as a reform of the problems seen as inherent in single-member systems. The main problem is simple enough. The "winner take all" plurality system not only permits candidates with less than a majority to win, but over a state or country often results in a wide electoral bias — or disparity between proportions of votes and proportions of seats (Tufte 1973; Brookes 1960; Johnston 1976a). The most notorious example is perhaps that of the Liberal Party of Britain, which in 1974 received 18% of the vote, but only 2% of the seats! The New Democratic party in Canada suffers similarly, but even in the United States with just two parties, the electoral bias is often great. For example, in Washington State the 1978-80 senate was 2/3 Democratic even though the vote balance was about 53:47. Obviously, the aggregate desire of voters is denied; can this be what "equal representation" means? Not for British Liberals clearly! Especially where there are three parties as in Britain and in Canada, but also in the U.S., two other undesirable effects may appear. The governing party may well have a minority of overall support, and the winner-take-all principle may result in sharp regionalization of representation. Historically this is evident in the U.S. through terms such as the "solid South" (Democratic) or "rock-ribbed Republican Midwest" (Bullock 1975). A striking example is the present Canadian government in which the Liberals have no seats elected west of Winnipeg despite a significant total vote, and therefore no possible representation of the west and its needs in the Cabinet. Conservatives and NDP, despite substantial votes, were virtually shut out of Quebec.

Defenders of the single-member system stress the value and importance of effective governance. They believe it is desirable for one party or the other to get a strong enough majority to take decisive responsibility for governing. Proportional representation is likely to result in a multiplicity of parties, the necessity to form shifting coalitions, and thus inherent instability. There is some support for the latter concern in the cases of Italy or Belgium, for example, but Scandinavian countries have enjoyed great stability despite many parties with proportional representation. Defenders also suggest that over time, electoral bias for one party tends to be balanced by corresponding electoral bias for the other, "proportional representation over the long run." This is supported by British and U.S. experience. Finally, defenders stress the sense of a

"contract" between an individual and a restricted constituency in contrast to the impersonality of party slates in many member constituencies under proportional representation. Some alternative reforms will be briefly considered.

Modified Single-Member Systems

Single Member – Alternate Vote

In the single member — alternate vote system voters rank the candidates. If no one obtains a clear majority, the lowest is elminated and his supporters' second preference votes are distributed among the others, until one gets 50% (Australia).

Single Member – Double Ballot

After the usual first ballot, weak candidates may withdraw (French National Assembly). In any event, the one with the most votes wins in the second round. In France, this frequently results in an anti-communist coalition on the second ballot, resulting in a severe electoral bias against the communist party. In the U.S. this double ballot is common in primary elections, mainly in the South. However, all but the two top candidates are eliminated for the runoff.

Preferential System

In this system, used in Ireland and the Australian senate, the voter ranks the candidates *(e.g.,* 1 to 3). Any candidate with over the minimum electoral quota of first place votes is elected:

$$Q = \frac{\text{total 1st place votes}}{\text{seats} + 1} + 1$$

If there were 100,000 votes and three seats, then **Q** = 25001. Clearly, if three candidates got this minimum, no others could be seated. Extra votes, exceeding the minimum, are distributed to the other candidates in proportion to voters' second preference strength. This may bring another candidate over the quota. If not, the lowest candidate is eliminated and his second preference votes distributed.

It may be generalized that when there are three seats to a district, the majority party will tend to get two, the minority one; with five members, a third party has a fair chance of getting one seat. A party in power will want to create three member constituencies where strong; and four member constituencies where a slight minority, thus "winning or drawing" and never losing!

Proportional Representation

Single member plurality electoral systems and modifications exist mainly in English speaking countries and in France. In many more countries, including the rest of continental Europe, election is by proportional representation. For example, proportional representation prevails in Italy, Scandinavia, Belgium, and The Netherlands. The purpose of proportional representation is to grant each party seats in relation to its total

vote. This is accomplished through use of multi-member districts, with anywhere from three to 25 or more seats, and through other devices to overcome electoral bias. The voter typically votes a party list, but may well also vote one or more personal preferences. In the "simultaneous list" version the party votes are allocated equally to candidates on the list. Thus how many candidates are put up is critical. In the "party list" method, all the party's votes go to the party-preferred candidate. Any extra votes go to the second party candidate. Differential *personal* votes establish a priority ranking in the case of a simultaneous list, and can alter the ordering in a party list.

The seat entitlement may be determined by several rules. For example, with the d'Hondt rule used in Germany and Scandinavia, the total number of votes for each party is divided successively by 1, 2, 3 to m (the number of seats); allocation is to the largest quotients. For example, suppose three are to be elected:

Party A	Party B	Party C	
42,000	30,000	18,000	Divide by 1
21,000	15,000	9,000	Divide by 2
14,000	10,000	6,000	Divide by 3

With three seats, Party A gets two (two at 21,000 of the total 90,000) and Party B one seat (at 30,000); but if there were four seats, Party C would get one of them (at 18,000) and with five seats B would get a second seat (two at 15,000). Obviously, the larger the number of seats in a constituency, the closer the allocation matches the proportions of votes, but, on the other hand, the more "distant" the representative becomes from individual citizens. At one extreme, Israel and The Netherlands elect all parliament members from one national constituency. Other countries have varying-sized constituencies, usually depending on density. For example, Denmark's vary from 2 to 17.

As a compromise, many countries prefer fairly small constituencies of from three to five seats, resulting in some deviation from proportional representation. However, some "national" seats are usually retained for what is called a "topping up" process. The national seats are allocated to parties so that the final proportions of all seats, national and constituency, reflect the national party proportions. This allocates seats to the various small parties which get above a minimum share of the national vote, but are unable to win many constituency seats. In West Germany, one-half the seats are from single-member districts, which results in the total shutting-out of Free Democrats, who received the minimum five percent of the vote in several Lander (Laux 1973). The second half of seats are allocated via a "topping up" so that the final allocation is proportional. This dual system is called the "additional member" system.

Evaluation of Electoral Reform

It is true that in U.S. and Canadian politics, local and regional interests are often emphasized, but this is more attributable to the federal philosophy than to single-member districts, since this degree of localism is not characteristic of Britain or France. It would not be possible or fair to proclaim single-member or proportional represenation "better" from the point of view of either effective government or the quality of representation and participation (Paddison 1976). As a participant of one system I am inclined to defend it on the ground that the close tie between a representative and the home area represented is an inherent part of our culture. We believe in geographic localism as the basis of representation, that districts are not just arbitrary conveniences for electoral purposes. We then rely on other mechanisms to instill a sense of the greater good. According to this view the nation is the sum of local results or decisions, and there is no ethical need to top up to national preferences.

Still, as in the case of Britain, the system is so obviously unresponsive to Liberal strength that the need for reform is widely felt (Rowley 1975a; Johnston 1977a). One suggestion would be for a dual system, as in West Germany, but with no attempt at a full topping-up equalization. For example, 2/3 of members might be elected by single member districts as at present, while the other 1/3 might be allocated on the basis of proportional representation according to a party's share of the total vote in large regions. This would combine the principle of local majority or plurality rule and a degree of national (regional) responsiveness.

Clearly, the choice of representation system and election can have profound regional consequences. Election of a number of representatives at large, although prevalent in elections at lower levels in the United States, will tend to submerge and disenfranchise racial, linguistic, or territorially-based minorities, for example, rural interests where the city dominates the region or urban interests where the rural population is larger. On the other hand, single member districts can lead to parochialism and such common American consequences as "pork barrel" legislation, spreading public works across the set of districts. More seriously, a debilitating local veto of necessary but undesirable facilities or industrial developments can occur.

5

Redistricting Methods

Previous chapters have dealt with the evolution of requirements for redistricting, as well as critiques of these requirements. My conclusion was that districts should not be viewed as mere temporary partitions of territory for electoral purposes. Although subject to change, districts should have some meaning or identity to residents and representatives. I also concluded that it is futile to pretend that a political process can escape politics and that it is therefore wiser to incorporate political criteria into the redistricting process rather than have unwitting political effects. This chapter deals with data problems encountered in trying to carry out redistricting and with computer and non-computer methods of districting.

Data Issues

To carry out redistricting, an obvious legal requirement is for accurate population data, including racial minority and Spanish-speaking components for areas sufficiently small to meet population equality requirements (Dunn and Billington 1974). Only census enumerations are legally acceptable, except in unusual circumstances. In addition it is desirable to have data concerning existing district boundaries; social and economic characteristics of areas such as identifiable communities and trade areas; and political election results over several past elections.

Data Units: Census Units and Political Precincts

An absurd but fundamental incongruence exists in most states between census geography and political electoral geography. That is, the Bureau of Census requires that census tracts, enumeration districts, and blocks all follow "easily recognizable" boundaries such as roads, rivers, and perhaps transmission lines and aqueducts, but not "invisible" property and political lines. Political precincts are historically based on land divisions (property lines) since in cities, for example, voting on bonding or other financial matters may be based on assessed valuation of properties in voting units. States, political parties, and local governments naturally wish to use precincts as building blocks for districts, since they want to avoid changing the system of familiar precincts and since political returns are by precinct. Most courts, but not all, have required use of census enumeration units on grounds that precinct populations cannot be determined accurately.

For large districts where deviations of more than 3,000 are acceptable, counties, census county divisions or townships (towns in parts of the Northeast), and incorporated places will be satisfactory units for redistricting. Only occasionally will it be necessary to resort to census enumeration districts. For metropolitan areas, incorporated cities and/or census tracts will normally suffice. Use of blocks or block groups or enumeration districts may be necessary where census tracts and incorporated cities do not coincide. It may be easiest to define districts by census tracts, but to adjust the final boundaries to corporate limits, in order to avoid splitting cities.

For smaller districts, such as county supervisor districts, legislative districts in smaller states, or city council districts, it is usually necessary to use the MEDLIST (Master Enumeration District) tape or printout for rural areas and block group or even blocks in metropolitan areas. By March 1981, the Bureau of the Census provided a microfiche and tape of total 1980 population, by race, for all tracts, enumeration districts, and blocks. Unfortunately, in rapidly growing urban fringe areas, enumeration districts and block groups may be too populous. Many "superblocks" may exceed 2,000 persons. These cause considerable practical difficulty in trying to meet equal population requirements without undue distortion. Precincts may be used where enumeration districts are too large, according to *Stewart vs. O'Callaghan* (1972).

If a state, county, or city intends to try to use precincts for redistricting, then an intermediate step is required to estimate their populations. Nine states participated in an optional census program to obtain counts by precincts. Even in blocked areas and cities this involves splits of blocks and enumeration districts. Split populations are difficult to estimate and subject to substantial error. The most satisfactory and legally defensible manner of estimation involves these steps:

(1) Map overlay of precincts and enumeration districts. The census versions of the county highway maps or U.S. Geological Survey topographic maps may be used outside the Metropolitan Map Series areas. Typically there is a very poor match of precincts and enumeration districts.
(2) Estimation of number and proportions of housing units in split portions of enumeration districts and precincts.
(3) Allocation of populations to precincts on the basis of differences in registered voters. The ratio of voters to population will need to be recalibrated for different areas.
(4) Check on uncertain areas, if necessary, by use of air photos or even field survey.

Even with these precautions, estimates of the populations of typical precincts must be considered subject to a 15 to 30 percent error. The error becomes larger as precincts become smaller. Depending on how many census enumeration districts must be split in the makeup of a district, a potential error or uncertainty of 1,000 or more will not be unusual. It is preferable, therefore, to use census units, splitting as few precincts as possible. This suggests that parts of the split precincts retain the same name or number but be designated as A or B portions. A few states have obtained block-level data for the entire state, from which reasonably accurate precinct counts can be made.

When enumeration districts are to be used in redistricting it is highly desirable to create a "correspondence list" between precincts and census units, so that the political effects of various redistricting plans can be estimated. Planners, social scientists, and lawmakers can match electoral returns (especially on issues) to population characteristics (DeRubertis 1969).

Census Values and Population Estimates

Normally census data are required for redistricting purposes. Concern is often expressed about accuracy of the census and about the obsolescence of census data over time. Analysis of the 1970 U.S. census revealed significant undercounts, particularly for minority and/or poor populations, whether urban or rural. For the 1980 census, great effort and money was invested in reducing this undercount. The 1980 returns show a larger population than expected, particularly of the Hispanic and other minority populations, suggesting that the effort was successful. Nevertheless, Detroit, St. Louis, Cleveland, New York, and other cities which lost substantial population have challenged the accuracy of the 1980 count, and have asked for an adjustment of the figures. Such adjustments appear possible for large units like cities or states but are not feasible at the level of the census tract or block. Field checks by census supervisory personnel indicate that these cities do not want to face up to the reality of decline. Despite criticism and adverse publicity, the census is remarkably good, and there is no basis for using any other figures.

Since populations obviously change significantly over time, there is an incentive for growth areas to seek early redistricting on the basis of population estimates. Small area population estimates are inherently uncertain, however, and have rarely been accepted by courts. Indeed, the bill which authorized the 1985 Mid-Decade Census for the United States explicitly disclaimed its use for redistricting purposes. Redistricting once a decade, as required in federal and state constitutions, was sufficiently disruptive.

There is also occasional interest in redistricting on the basis of current voter registration, rather than population, because registration data are available and current and because they supposedly represent "concerned citizens." Generally this will be disallowed by the courts, in part because minorities tend to have lower rates of registration. Registration data can be justified if and only if it can be shown, on the basis of earlier census and registration data, that there was no real difference in rates of registration across the territory in question (*Burns vs Richardson*, 1966).

Map Adequacy

The redistrictor will find that maps are an essential but frustrating part of the effort. In areas covered by the Metropolitan Map Series, the task is reasonably straightforward, although there will probably be some errors, such as block numbers. Outside built-up metropolitan areas, however, the necessary enumeration district maps are often of deplorable quality since in the U.S. reliance is placed on the country highway sheets produced by state departments of transportation. These are barely suitable in low density areas and are often illegible in higher density areas or chopped into confusing insets. Indeed, those attempting redistricting in 1981 found the quality and accuracy of the advance maps rather poor, greatly increasing the task of preparing a data base.

The greatest difficulty is in the urban fringe of towns and small cities, where incorporated portions are on separate maps at many scales. It may take a considerable time and effort to assemble the necessary maps, to determine the precise enumeration district boundaries, and to relate these to precinct maps.

Since adequate base maps for evaluation and presentation of redistricting plans probably do not exist, it will probably be necessary to prepare them using a state or region-wide map at a smaller scale and metropolitan maps at a consistent larger scale. These can be reduced versions of composites of the Metropolitan Map Series, but these are cluttered with irrelevant information. It is preferable to prepare maps which

show only census tract and corporate limit boundaries or possibly block groups and ED boundaries, if districts are small. Ideally, the maps are computer-generated using digitized boundaries of the data units, because then it is easier to generate alternate districting plans.

Practical Redistricting Procedures

Because of the very large amounts of demographic and political data, and because of the desire to measure and compare alternative plans, computers are increasingly utilized in the redistricting process (Craig 1973; Garfinkel and Nemhauser 1970; Gearhart and Littschwager 1969; Hess *et al.* 1965; Kaiser 1966; Littschwager 1973; Massam 1972; Nagel 1965, 1972; Savas 1971; P. Taylor 1974; *REDIST* 1967). Computer algorithms are in themselves not very subtle and, in their pure form, tend to produce inadequate solutions. Yet when used in combination with human judgment they can be very useful. In this section we will review both computer and non-computer procedures for redistricting tasks:

(1) Preparation of the data base;
(2) Adjustment of existing districts;
(3) Regionalization of sets of districts;
(4) Interactive district formation;
(5) Optimum redistricting;
(6) Evaluation of district plans.

Preparation of the Data Base

Adequate redistricting involves the manipulation of many items of information, for example, population by race and language and political returns for several key races, for perhaps thousands of data units — counties, cities, tracts, enumeration districts, block groups, and perhaps blocks. In addition, it is highly desirable to be able to map the locations and/or boundaries of the data units. A computer data base will be difficult to construct, but is worthwhile, not only for redistricting itself, but for political, geographic, and other research throughout the years.

A data file on disk or tape should ideally have the following data: ID number of the data unit, including county or city identifier; total population; Black, Asian, Indian, other races, and Hispanic population; Democratic or Republican vote in recent representative elections; and spatial coordinates. In addition, the data unit boundaries should be digitized. Digitizing may be difficult because of the inadequacy of available maps. Converting political data from precincts to census units, however, will occupy ninety percent of the data base time. Not only may it require many man-months, but it is subject to significant error because of the incompatibility of precincts and census geography. For this reason, there may be an advantage in creating two data bases, a more geographically detailed one without the political return data at the enumeration district or block group level, and a less spatially detailed one with political data, at the census county division, city, or group of tracts level. The essential population data can be taken off the official census tapes. Many cities or councils of government will have digitized local census information.

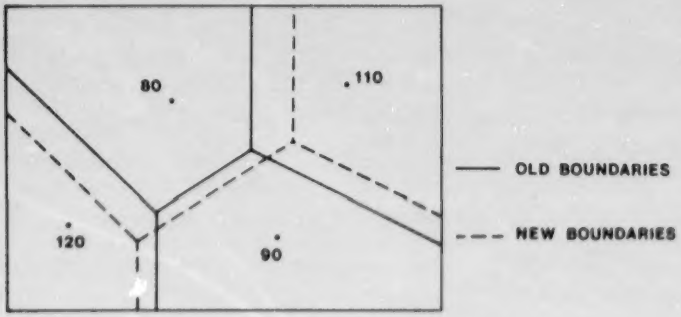

FIGURE 7 USE OF THE TRANSPORTATION PROBLEM IN REDISTRICTING. If the population is evenly distributed and each district should have a population of 100, a graphical solution to the transportation problem shifts the boundaries until all populations reach 100, maintaining the triple boundary junctions.

Adjustment of Existing Districts

The typical redistricting plan must be approved by the body to be redistricted, even if the districting plans are drawn up by staff or consultants. Chances of passage are obviously affected by the degree of disruption of existing districts. The wisest initial strategy is therefore to discover the minimum amount of change required to meet the equal population requirement, by calculating the populations (by race, if pertinent) of the existing districts, and to estimate the number of districts, if any, that will have to be shifted into or out of broad regions.

Where the imbalances are not too severe and there are no large areas of consistent gain or loss, such that all present districts are likely to continue in modified form, the familiar *transportation problem* is an ideal method (Nagel 1965). Each existing district has a "surplus" to be given to other districts or a "deficit" to be gained from others (Figure 7). A computer program minimizes the travel required to match surplus and deficit, and brings each district to the correct size. The traditional "transportation problem" formulation is useful, in which the user is required to specify a "cost" of attaching each sub-area to alternate districts, since it is possible to incorporate more than simple distance in the costs, for example travel time on real roads and costs or times modified by such factors as community of interest or breaking versus respecting political boundaries. For example, one may impose a "penalty" or higher distance for attaching units across a county or city boundary, or for separating a linguistic or racial minority.

If the total number of districts will not change, the centers of existing districts are reasonable intitial locations to submit to the computer. For sets of districts for which districts must be added or deleted, the adjustment task is slightly more challenging. If a sub-region is to lose a district, it is logical to omit the district center which is most underpopulated. If the sub-region is to gain a district, it is logical to propose a new initial center in between the pair of existing districts with the largest excess population.

Most computer centers should have versions of the transportation problem available. NETFLO, for example, requires the user to specify all distances, while LAP computes the distances internally on the basis of coordinates.

Regionalizing Sets of Districts

Except in very small problems, such as dividing a county into three supervisor districts, the redistricting task is greatly aided by making it a two or three stage process of subdivision into manageable sub-regions. It is generally very useful, irrespective of computer use, to divide the state or other large complex territory into broad regions or sets of districts within which the detailed districting will be accomplished. A desirable procedure is to divide the state into sets of counties which are entitled to an integral number of representatives, not necessarily equal but probably between five and eleven. Ideally, these broad regions will possess some sense of unity. For example, they may be existing state planning regions or geographic regions as in Mississippi: the Delta region (west), the Gulf (south), and the east. This regionalization, with counties as data units, is an ideal stage in which to use a computer grouping/clustering algorithm. Again, most computer centers will have cluster analysis programs available. The BMDP or SPSS programs are perhaps most common. In this regionalization, the coordinate locations of the counties will probably be strongly weighted, so that resulting regions are contiguous.

Iterative Formation of Districts

Even if there is little interest in "optimum computer redistricting" on the part of partisan politicians, the computer may be very useful. It is fairly easy to write a program to permit interactive formulation and alteration of districts. For example, a data base may be prepared giving the coordinate location, population by race, prior electoral results, and other desired characteristics of all the basic data units. These may be aggregated and evaluated by simple listing, adding, and deleting. The program may ask, for example: "What units are to make up this district?" The user types in a set and is told the character of the results, whether too large, too "safe," too racially diluted, or whatever. With considerably more effort, such a program will permit use of an attached map, translating the tracing of a boundary, a closed perimeter, into the enclosed population and its characteristics. The only programs with such a graphic capability are proprietary and rather expensive. The Rose Institute for State and Local Government has one available.

Whether or not the formation of districts is to be done by computer, several guidelines may prove useful. It is easier to work with larger units, such as counties, incorporated places, or census tracts, and then to shift to smaller subdivisions, such as blocks and ED's, to make refinements necessary to meet equal population requirements. Second, it is wise to begin the process from all *corners* and work to a convergence in the middle of the territory, in order to avoid severe distortion which may result at a corner or edge if the process starts from just one origin. Third, it is also wise to begin with that corner or section with the least discrepancy in population size between existing and needed districts, in order that stability in the set of districts is preserved where possible.

Optimum Redistricting Programs

Because of the overriding importance of population equality, it is the controlling constraint in the typical redistricting algorithm. The objective function may vary somewhat, but the most common is a simple geographic one, "compactness" of districts, which is mathematically equivalent to minimization of total system travel to the set of hypothetical centers of districts. This is in fact the constrained version of the location-

allocation algorithm, and has been programmed by Garfinkel and Nemhauser (1970); Weaver and Hess (1963); Goodchild and Massam (1969); and the National Municipal League (*REDIST* 1967). LAP is also effective (Rushton *et al.* 1973).

The problem may be expressed as follows: Assume **n** origin areas each having population p_i and **m** districts each with population q_j. Let x_{ij} be the population assigned from area **i** to district **j** and let d_{ij} denote the distance between area **i** and district **j**. The program then minimizes:

$$\text{MINIMIZE} \quad \sum_{i=1}^{n} \sum_{j=1}^{m} x_{ij} \cdot d_{ij} \qquad \text{(minimize aggregate travel from areas to districts)}$$

subject to:

$$\text{for all } i, \quad \sum_{j=1}^{m} x_{ij} = p_i \qquad \text{(assign total origin population to districts)}$$

$$\text{for all } j, \quad \sum_{i=1}^{n} x_{ij} = q_j \qquad \text{(assignment to each district totals } q_j\text{)}$$

$$\text{and} \quad q_j = \frac{\sum_{j=1}^{m} q_j}{m} = \frac{\sum_{i=1}^{n} p_i}{m} \qquad \text{(all districts have equal population } q_j\text{)}.$$

This problem is usually solved by "heuristic programming," an iterative procedure which works toward an optimal solution. Since there are an infinite number of locations for each district, an exact analytic solution is not easy to find, at least in large problems. An iterative procedure is common in the algorithms. First, choose m (number of districts to be found) initial locations, either by random numbers, arbitrary guesses, some systematic procedure such as even spacing, or centers of pre-existing districts. The latter is useful if change has not been too great and an objective is to minimize disruption of the present incumbents. Second, assign, via the linear programming transportation problem, the population to the m centers, subject to the equal population constraint. Third, find the population centers (bivariate medians — points of minimum aggregate travel) of each district. Fourth, again assign the population, via the transportation problem, but to the new centers. Fifth, find the population centers of the new districts. The process of assignment and calculation of centers is repeated until no further change in assignment or location occurs (Figure 8). An optimal solution has these properties:

(1) System travel is minimized, subject to the equal population constraint;
(2) Each district is characterized by a center which is the bivariate median of the population assigned to it, the point of minimum aggregate travel of its population;

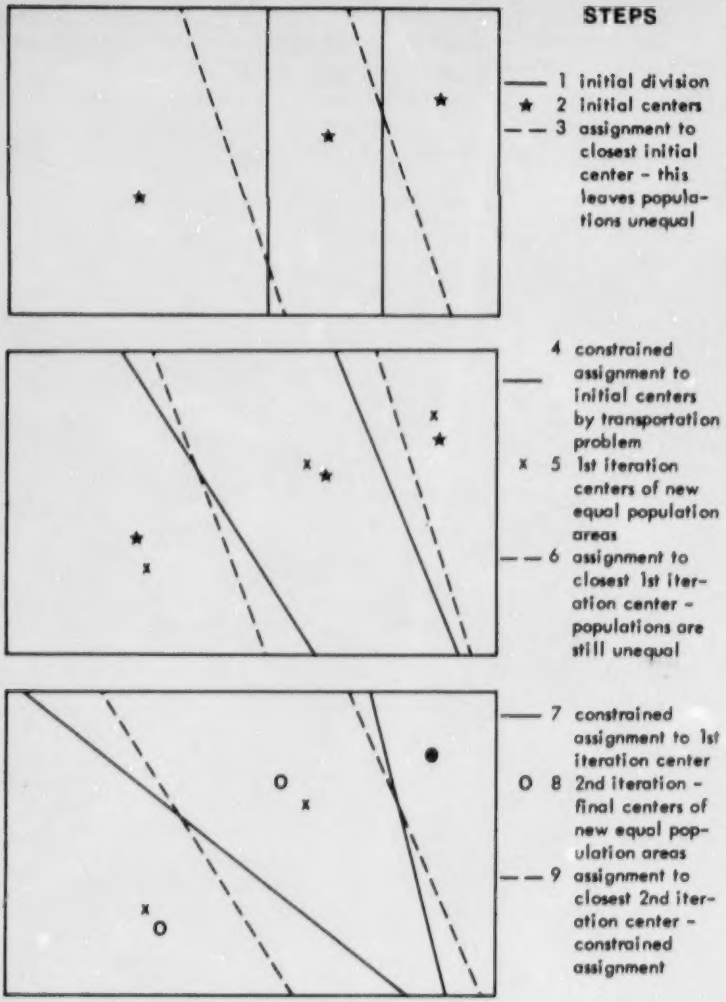
STEPS
1 initial division
2 initial centers
3 assignment to closest initial center - this leaves populations unequal
4 constrained assignment to initial centers by transportation problem
5 1st iteration centers of new equal population areas
6 assignment to closest 1st iteration center - populations are still unequal
7 constrained assignment to 1st iteration center
8 2nd iteration - final centers of new equal population areas
9 assignment to closest 2nd iteration center - constrained assignment

FIGURE 8 OPTIMUM REDISTRICTING MODEL. Steps 3, 4 and 6, 7 are usually combined in programming. The final regions are compact with respect to shape and population distribution.

(3) All boundaries define the most compact regions possible, given the population equality constraint.

These computer programs thus satisfy two prominent criteria for redistricting, population equality and compactness as a blind defense against gerrymandering.

However, in using such models, some warnings are in order. Because maintaining county and city boundaries to the extent practicable is a common criterion, and because the cost of computing and the quality of solutions are in part a function of the number of data units, it is better to use whole counties and cities as data units, breaking up only those larger than a district. Because of constitutional constraints against diluting minority voting strength, it is also prudent to create fairly homogeneous data units out of areas with racial or linguistic minorities, especially if these are smaller than a single district. This sacrifices total travel and compactness to the extent that the political or cultural units are irregular, but usually to a minimal degree, and achieves the added criteria of minimizing the number of political boundaries broken and of respecting the integrity of minority populations.

Another reason to use larger administrative units is because optimum computer solutions may be too geometric, emphasizing compactness but not dealing as well with community-of-interest criteria. Thus it may be preferable to achieve an approximate computer solution, and then to refine it on the basis of additional knowledge about the local region. For example, a computer solution may "combine" cities A and B, and 4,200 people from city C in forming a district. Rather than disaggregating City C to smaller units and employing the same optimum districting program, it may be preferable to shift to other methods and additional data to test several alternatives to taking 4,200 from C, and comparing results according to such criteria as political balance and communities of interest.

Despite claims of some programmers, the current generation of algorithm solutions deteriorate as the number of districts requested rises, and costs rise geometrically. It is very unwise to find more than ten or 12 districts, and even then, it will be necessary to begin with several initial sets of locations in order to be reasonably sure an optimum is reached. Since 50 or 100 districts may be required, this means the solution must be in two stages. For example, a first stage finds five regions, then a second stage finds ten districts in each region. Actually, in the first stage, it may be useful to perform a more general regionalization on a wider set of social, economic, and environmental variables, as well as location, in order to define broad "communities of interest", and then to adjust them by a programming algorithm to the closest integral number of districts.

It may be beneficial to utilize a capability to impose barriers in which distances must be computed around the ends of a "barrier," as is available in the LAP program, in order to avoid districts crossing such obvious breaks as uninhabited mountain ranges or major bodies of water. This may be essential to maintaining contiguity.

Most important, it is preferable to treat solutions as starting points rather than ardently defended products. The reasons for such humility are mathematical, political, and geographical:

(1) *Mathematically*, several quite different solutions may have very similar efficiency or total travel;
(2) *Politically*, minor boundary adjustments might significantly reduce the number of incumbents placed against each other — a matter greatly affecting a plan's acceptability!
(3) *Geographically*, most computer algorithms are too geometric, utilizing "airline" distances, and ignoring route limitations, travel times, trade and allegiances, and communities of interest.

It makes sense to adjust algorithm boundaries in favor of real patterns of allegiance and communities of interest to the extent that these are known and are important to residents.

Another useful procedure is to begin with a solution found by an optimum districting algorithm like LAP. Then one can utilize a standard transportation problem program, treating the LAP solution centers as fixed destinations, but developing a far more meaningful measure of distance from all population units to these centers. For example, travel time on actual routes, or a penalty distance for crossing city, county, or racial boundaries may be included.

Computer Evaluation of Districts

Even if computers are not used in district formation, it is essential in all but small problems to develop a data base of characteristics so that any given plan can be evaluated according to the chosen criteria — population deviation, racial dilution (chance of electing minorities), political balance or competitiveness, or homogeneity of character (measured, for example, by the standard deviation of some indicator such as income relative to the system-wide values).

It is easy to write a simple program that takes a list of component units and calculates total population by race, vote totals for critical political races, and other useful characteristics. What constitutes an acceptable degree of population deviation, racial packing or dilution, or ratio of safer to more competitive districts will probably depend on state, county, or court-specified criteria. It is easiest to evaluate spatial criteria like compactness by reference to a map of the plan, comparing maximum and minimum diameters right from the map.

Computer-Assisted Redistricting

Tremendous improvements in computer processing and graphics capabilities over the last decade have outpaced both the adequacy of readily available redistricting computer programs and the data and map bases. Nevertheless, it is reasonable to predict that most large redistricting efforts will find computer assistance necessary. A data base stored on disk or tape is almost essential. This in turn permits three valuable computer-assisted activities:

(1) Interactive district creation by adding and deleting units;
(2) Summary and evaluation of the characteristics of districts;
(3) Graphic presentation of the resulting districts.

Many geography faculty and graduate students have the ability to program these operations. An optional, but often valuable, use of the computer is to divide the state or area into broad planning regions, if this has not already been done. Standard programs are available for this task. Finally, program packages are available for the actual derivation of optimal redistricting plans, although at present such plans are better treated as good starting places, a basis for further refinement.

Redistricting Services

Problems and requirements vary from state to state and by governmental level. Nevertheless, the prospective redistrictor should be prepared to offer the following capabilities:

(1) Familiarity with maps and census data, and the construction of a computer-accessible data base. A capability for producing computer graphics is useful;
(2) Since many will have census data and computer expertise, the geographer should also emphasize familiarity with the local geography, neighborhoods, and communities of interest;
(3) An ability to apply a computer model, together with willingness to adjust or modify results according to other needs;
(4) An ability, if desired, to allow "hands on" or interactive participation by government and interest groups involved, including a quick evaluative response to proposed adjustments.

A redistricting report normally consists of the following components:

(1) A legal description of the components of districts, either in terms of voter precincts, if requested, or official census units;
(2) Maps of the districts, probably at two scales, one for the system as a whole, another for detailed boundaries in higher density areas;
(3) An accompanying narrative which discusses and defends any significant deviations from population equality, major deviations from compactness, how the plan serves representational equity by protecting minority interests, how the plan tends to respect communities of interest, and, if requested, how the plan meets political objectives.

Levels of Redistricting

Much of the earlier discussion emphasized the problems of reapportionment of parliaments and congresses, and of redistricting state legislatures. In the United States, the courts first intervened at these levels (*Baker vs. Carr*, 1962; *Wesberry vs. Sanders*, 1964). But the principle of "one-man, one-vote" was soon extended down to all levels of government with elected representation. In the United States this included counties, incorporated cities, towns and villages, unincorporated towns in New England, boroughs and townships in many northeastern and midwestern states, school districts, and many other kinds of special districts (water, fire, park, library, sewer, irrigation). In general, higher levels of population deviation are permitted at lower governmental levels, perhaps a deviation of ten percent or more. Especially for cities, but also for many counties and special districts, at-large election is common, a heritage of the "good government" era attack on the parochialism of "ward politics." There is a basic American ambivalence on this issue at the local level. The voters of Seattle more than once voted to retain at-large elections, yet in the county charter election, voted to create a county council by district. The same ambivalence applies to partisanship: Seattle's council is non-partisan but the wider county council is partisan.

In most of the United States the county is the basic level of local government, yet traditionally its powers were very limited. A common convention was to create districts,

not of equal population, but with equal miles of county roads. The rapid suburbanization of counties beyond the incorporated city, followed by the "one-man, one-vote" decision, has broken down such conventions, and now the criteria for and problem of redistricting at the local level are a microcosm of those at the state level.

Who Should Redistrict?

In the vast majority of jurisdictions, including parliaments, congresses, legislatures, provincial assemblies, city councils, boards of supervisors, and boards of education, the elected body is responsible for its own redistricting. This might seem strange, until we realize that a districting plan is a statutory act. Only elected representatives are normally able to enact statutes, although in some states, it may also be done by initiative. In addition, elected bodies are constitutionally the judge of their own members' eligibility. Naturally, this situation creates a conflict of interest; the incumbent representatives are in a strong position to manipulate a new plan for their own (or their party's) benefit and regularly do so. Reformers attack this practice not only on the grounds of political fairness, but also because so much time and effort is expended, or other important legislation held hostage, to what is really a temporary matter. The critic asks why only these few should have the privilege of setting their own salaries and manipulating their own survival on the job, when most of society cannot (Adams 1977, 1978; Buchanan 1977; Lyons 1969).

As a consequence of reform sentiment, some states have turned over the districting process to an independent commission. The Boundary Commission for the British Parliament, created in 1949, is an excellent example. Nine U.S. states have commissions, although only three are completely independent of the legislature. Many local governments find it useful, even if not legally required, to turn the task over to a presumably independent consultant or group.

Reformers, notably Common Cause, the National Municipal League, and the League of Women Voters, have proposed model redistricting provisions. They argue that political gerrymandering (a) dilutes the value of voter participation because the results tend to be predetermined, (b) reduces legislator responsiveness, (c) reduces competition and therefore legislator quality, (d) ignores the interests of fragmented political jurisdictions, (e) wastes money and legislative time, and (f) often fails (in the 1970's, 17 states had to be redistricted by the Courts). They believe that the process must be taken out of political hands.

In 1981 41 state legislatures have total redistricting responsibility, while in nine, boards or commissioners are assigned the task (National Municipal League 1971). However, in six of these, the process remains political. Only Colorado, Hawaii, and Montana have non-political commissions (Kugisaki 1978). The model process, based on these states, includes three elements:

(1) Rigorous anti-gerrymandering standards: equal population, a compactness standard, respect for political boundaries, and prohibition of the use of electoral data;
(2) An independent, non-partisan or bi-partisan commission. In Montana, each party in the legislature appoints two commissioners, who in turn select a fifth. None may be office holders.

Others have suggested up to 11 commissioners, with seven appointed by the State Supreme Court;

(3) Prompt judicial review.

It is of interest that 29 states require "contiguity"; 22 states "compactness," although this is rarely enforced, since it is not defined; and 17 states provide for State Supreme Court review.

An example of voluntary shifting of the job occurred in the Mississippi legislative case (Chapter 6). The Supreme Court *(Connor vs. Finch,* 1977), had rejected earlier legislative plans, so the legislature hired a special staff to devise plans and reserved for itself only the right to accept or reject, but not amend, the recommended plan. This process resulted in an amazingly fair plan that met all Supreme Court requirements for racial fairness after 12 years of litigation.

In cases of successful litigation against a plan, or when a body is simply unable to redistrict itself, the process may be taken over by the courts. In this case the court will appoint a "Special Master" who prepares plans for court decision. The court will typically hold hearings and permit objections to the plan from interested parties. For example, in its 1972 session the Washington State Legislature was unable to reach agreement on a plan. The Federal District Court accepted a case lodged against the state for failure to redistrict according to the constitutional mandate. The court appointed me Special Master and accepted stringent criteria suggested by the plaintiff. Interested parties were permitted to submit suggestions and recommendations. After the plan was submitted, the court permitted wide discussion prior to its acceptance.

Virtually everyone, including the courts, agrees that the courts should not be the agencies responsible for redistricting, but that it should be done in the appropriate jurisdiction. The question is then whether the task should be given over to an independent body, as reformers argue, and, if so, whether the criteria should be strictly non-political.

In principle, I support the creation of an independent commission to redistrict. However, the model legislation errs, I believe, in pretending that redistricting can be non-political. Thus I would urge states to consider establishing an independent commission, but with somewhat broadened criteria:

(1) Equal population;
(2) Reasonable compactness and contiguity;
(3) Avoidance of racial dilution;
(4) Respect for political boundaries;
(5) Changing the system of districts as little as necessary; and
(6) The overall political balance of a plan.

Since commissions are rare, what short-run alternatives exist? If a body produces a blatantly poor plan, it is possible for citizens to bring an action against it. In some states, citizens can file an initiative for a plan to replace the legislative one.

It is more desirable and realistic to attempt involvement and intervention in the legislative redistricting process by (a) fighting secrecy and demanding open committee sessions; (b) enlisting the media and interested groups (League of Women Voters, Common Cause, Young Lawyers) in maximum publicity and public interest; and (c) creating alternative plans, publicizing them, and submitting them to the legislature via friendly representatives as bills, so that they cannot easily be ignored.

Even better, it is desirable to create a cooperative relationship with the appropriate legislative committees, as by cooperating in the preparation of maps and data, so that

there is a prospect of being involved as a professional geographer rather than partisan agent. Where there is resistance to an independent commission, I encourage a bill which would formalize a "semi-detached" process whereby the legislature turns the redistricting over to consultants but reserves for itself the final decision on the plan.

6

The Mississippi Legislature

Many of the problems and potentials of redistricting, and particularly the role of a geographer as consultant in the process, are illustrated by my own contribution in two cases. The Mississippi state legislature was an example of blatant and eventually unacceptable districting as part of a century-long pattern of discrimination against Black Americans (Morris and Vocino 1966). The State of Washington case involves protection of incumbency and political gerrymandering. In this chapter and the next, we will examine these two cases.

Mississippi Apportionment and Voting

In February 1980, the Supreme Court in *United States vs. State of Mississippi* closed the longest-lasting voting rights-legislative redistricting case in the nation. *Connor vs. Johnson* had been filed in 1965! In truth, the case marked the end of a full century after reconstruction of systematic, pervasive, and effective discrimination against and disenfranchisement of the Black population of Mississippi. While this will not be the last suit related to the racial impact of an apportionment plan, it is the last fundamental legislative case to be resolved subsequent to the apportionment revolution ushered in by *Baker vs. Carr* in 1962 and the Voting Rights Act of 1965.

Mississippi, like most states, was vulnerable to complaint for a malapportioned legislature, having districts of highly unequal size. In addition, Mississippi was specifically covered in the provisions of the Voting Rights Act of 1965, due to its "long history of racial discrimination and disenfranchisement." The main thrust of the 1965 Act was in assuring registration and the very right to vote. The Act also made any Mississippi reapportionment plan at any level particularly vulnerable to complaint, since the wording of the Act permitted suits on the basis of a discriminatory *effect*, rather than having to show a discriminatory *intent*.

Actually, prior to 1965, Mississippi's reapportionment plans were not necessarily suspect from an "equal representation" (racial balance) point of view, simply because so few Blacks could register or vote. In 1964, only about six percent (28,000) of the state's registrants were Blacks. Mississippi used such devices as the literacy test, the poll tax, and the White primary, as well as intimidation, to exclude Black citizens from participation *(US vs. Mississippi,* 1965). The effect of this historic discrimination was lower Black participation in the political process, including both registration and voter turnout. It was only after Federal Registrars took up positions in Mississippi counties that apportionment became a potential "device" to deny equal representation.

Mississippi, from towns and counties to the state, resisted the changes that might be expected to follow from increased Black registration and voting. By 1971, Black registration reached 268,000 or 28 percent of the electorate. Because the Black population is younger on average than the White, a participation over 31 percent would not be expected, although Blacks constituted 36 percent of the population. The first White defense was the use of at-large voting in multi-member districts. After this device was turned down in a series of decisions (*Connor vs Johnson*, 1971, legislature; *Moore vs. Leflore County Supervisors*, 197?, county supervisors), the second phase of resistance was by gerrymandering — packing and diluting.

In 1965 a private plaintiff filed the complaint, *Connor vs. Johnson*, in the Southern District Court of Mississippi, challenging the constitutionality of the 1962 Mississippi legislative reapportionment plan. The 1962 plan, as well as successive legislative attempts to redistrict Mississippi's legislature for the 1967 and 1971 elections, were all held unconstitutional by the District Court (*Connor vs. Johnson*, 1966, 1967 and 1971 decisions; *Connor vs. Williams*, 1972). The basis of unconstitutionality was that at-large voting in multi-member districts intentionally and effectively denied equal representation to Blacks and diluted Black voting strength. Court-ordered plans were implemented in 1967 and 1971, but did little to raise Black representation (Van Knapp 1976, 1980).

In 1975 the Mississippi legislature again attempted a reapportionment plan. The plan was accepted by the District Court *(Connor vs Waller*, 1975) subject to clearance by the Justice Department under provisions of the Voting Rights Act that there was "no device the purpose of which was to deny or abridge the right to vote on the basis of race or color." The U.S. Attorney General did object to the plan on grounds that remaining multi-member districts as well as probably racially-motivated gerrymandering would tend to dilute Black representation. The District Court then ordered into effect its own "temporary" plan for the 1975 elections. The subsequent election did result in increased Black voter participation and the election of four representatives in the House, out of 122, but still none in the Senate. However, this was a small fraction of the voting age Black proportion of 31.5 percent. The District Court then formulated its own plan, "The 1976 Plan," for use in the 1979 elections. However, in *Connor vs. Finch* (1977), the Supreme Court held that the plan was still unconstitutionally malapportioned. In the 1971 *Connor vs. Finch* decision, the Supreme Court had suggested the use of single-member districts to "put to rest the suspicion of dilution" and also asked for explanation of departures from compactness.

The District Court Role

As well as drawing another plan itself, the District Court in 1977 asked parties — the Civil Rights plaintiff, the U.S. Department of Justice, and the State of Mississippi — to prepare and file proposed plans for consideration. The governor called a special session of the legislature which established a Special Joint Committee on Reapportionment. This committee retained Jerris Leonard, a former Assistant U.S. Attorney General for Civil Rights (for enforcing voting rights in Mississippi), as counsel, an action suggesting a serious intent to prepare an acceptable plan. The Committee then retained four consultants from outside the state, including myself, to assist in the formulation and evaluation of reapportionment plans. Strict criteria were laid down, including population equality, avoiding dilution of Black voting strength, avoiding splitting counties and cities, and creating compact and contiguous districts. The Committee turned the actual delimitation of districts over to the experts, and exercised

considerable discipline to prevent the legislature from intervening. Although legislative suggestions were taken into account, the Committee, and later the legislature and governor, essentially accepted the expert-prepared plan in April 1978, although it obviously meant revolutionary change in the Mississippi legislature. It seemed as if, after exhausting means of preventing Blacks from full participation and election, the White leadership accepted the inevitable, and adopted a plan as favorable to Blacks as any the Justice Department or the plaintiffs themselves could devise. (The reform of spirit is not complete. Even today the city of Jackson has both Black representatives and a senator, but its own city council is all-White, still elected at large.)

To avoid dilution of Black voting strength, a strategy was adopted which tended to create as many districts as possible that were under 15% Black (as low as possible), between 60 and 75% Black (55 to 65% voting population), and if this were not possible, districts between 35 and 45% Black, so as to constitute a "blocking" or decisive quarter in the key Democratic primary. Districts with over 70% Black were avoided, as "wasting" or "packing" Black voting strength, as were districts of 45-55% (40 to 49% of voters), the maximum dilution of Black voting strength. These numerical guidelines reflect the effect of the long-term history of racial discrimination which still inhibits Black participation, especially in rural portions of the Mississippi-Yazoo delta. In Jackson, Black participation no longer lags behind White levels, but in poor rural areas is but one-half to two-thirds of White levels. Redistricting involved, among other approaches, a shift to a compact or north-south structure of districts, in contrast to a traditional east-west districting which diluted Black majorities in the west by large White majorities to the east.

As a practical matter in ensuring acceptance of the plan, an attempt was also made to minimize the number of legislators who would compete against each other for reelection (only 6 of 16 senators, 16 of 122 representatives). Although I participated in the delimitation of districts, my main role in this case was the analysis and comparison of several submitted plans — the Legislature's statutory plan, the Plaintiff's plan (Henderson Plan) and a Justice Department plan.

Plans were drawn up on the basis of enumeration districts. However, the District Court asked that they be modified by delimitation in terms of precincts. This is contrary to usual court practice, but was adopted in this case to avoid the need for re-registration of voters. The Bureau of the Census cooperated by going back to original census returns to determine exact populations of many split portions of enumeration districts.

In June 1978, the District Court convened negotiation among the parties, which resulted in some boundary modifications which the legislature accepted (this is known as the "Settlement Proposal"). Meanwhile the statutory plan was submitted to the Attorney General for clearance under the Voting Rights Act. Owing to objections from the plaintiffs that their own plan was much better, the Attorney General would not give the plan clearance. The State then filed an action against the Attorney General in the U.S. District Court of the District of Columbia (which has special jurisdiction for cases under the Voting Rights Act), asking for a declaratory judgment in favor of the statutory settlement proposal. The original Black plaintiff then intervened, arguing that the plan would be "a retrogression in the position of racial minorities." While this plan was being argued, the Supreme Court instructed the Mississippi District Court to implement a plan for the 1979 elections. The statutory settlement plan was chosen.

The District of Columbia court accepted Mississippi's statutory plan, overriding the Attorney General's objection, arguing that the plan "constituted a clear enhancement of the position of racial minorities, because it included a greater number of Black voting age majority districts, and was the first to utilize single-member districts only." The

court relied in part on analysis I conducted which compared the plans with respect to (a) population equality, (b) compactness, and (c) representational equity, the probability of electing Black representatives. The statutory plan was clearly the most accurate and equal and had more compact districts; all three had essentially identical probabilities of electing Blacks. All three plans were far better on all the criteria than was the existing 1975 court plan. For example, the statutory plan contained 10 Black majority districts (out of 52 in the Senate) and 26 out of 122 in the House (Table 4).

Objections to particular district configurations were dismissed on the grounds that alterations would not affect the overall electoral outcome. The Justice Department and original plaintiff appealed the decision to the Supreme Court, but the 1979 elections resulted in a dramatic increase in Black representation, as well as affecting primary outcomes in many districts. Black representatives increased from 4 to 14, senators from 0 to 4. This undermined the basis of the appeal and the Supreme Court in February 1980 affirmed the judgment of the District of Columbia court.

TABLE 4 BLACK POPULATION PROPORTION IN MISSISSIPPI LEGISLATIVE DISTRICTS, 1975 AND 1979

PERCENTAGE BLACK POPULATION	NUMBER OF LEGISLATIVE DISTRICTS			
	HOUSE		SENATE	
	1975	1979	1975	1979
Over 75 (packed)	2	0	0	0
55-75 (ideal)	9	20	1	7
50-55 (blocking)	11	6	7	3
40-50 (risk of waste)	18	12	6	6

7

Washington State

Washington State reapportionment and redistricting problems have constituted an exciting area of legislative and electoral politics. As in many states the record has often been sordid. It has been characterized by legislative inaction resulting in extensive public and court involvement (Baker 1966; Teshera 1970; Morrill 1973a, 1976b).

1930-1960

After the legislature reapportioned in 1901 it refused to do so after the censuses of 1910 and 1920. Interested citizens therefore placed a reapportionment initiative on the ballot in 1930. It was adopted by the voters but was not to the legislature's liking. The legislature enacted its own plan in 1931. The governor vetoed the bill on the ground that initiated statutes were immune from repeal or modification for two years.

In the first election (1932) after the new apportionment, the legislature swung sharply from Republican to Democratic control. This could not be traced directly to the new law as the Democratic tide also brought a governor, U.S. senator, and all but one congressman; Roosevelt received 57 percent of the popular vote. The apportionment adopted by the voters had raised the legislature to the maximum constitutional size of 49 senators and 99 house members. This created nine additional seats; Democrats were, for the most part, the beneficiaries.

Again the legislature took no action after the 1940 census. Meanwhile, the population increased about 40 percent between 1930 and 1950. By 1950 malapportionment was receiving much attention in the press and by civic groups. The legislature came under mounting criticism for its failure to reapportion in 1951. The Legislative Council (an ongoing sub-group of the legislature) proposed a new apportionment plan in 1953 and 1955 but the legislature refused to touch it.

Meanwhile the League of Women Voters and its allies started an apportionment initiative but failed to obtain the requisite signatures to get on the ballot in 1954. Undaunted, supporters got a measure on the ballot in 1956, and it was adopted by the voters. But in the end the legislature outwitted the initiative supporters. Legislators, aware of the initiative efforts, proposed an innocent looking constitutional amendment in the same election permitting the legislature to "amend" an initiative by a two-thirds vote. The apportionment initiative carried by 42,000 votes, the legislature's amendment by 62,000 votes. Few people foresaw that in supporting both propositions they opened

the way for the legislature to emasculate the apportionment initiative. It did so almost immediately with amendments that were tantamount to repeal. The legislature restored a number of former districts; its action survived a state supreme court test in a much criticized 5-4 decision. While the new apportionment law was some improvement over the old, 24 of the 49 senatorial districts deviated by 25 or more percent and district populations varied in size from 20,454 to 145,180. Perhaps the major impact of the 1957 reapportionment law was to lock in the Democratic majorities in both houses which were elected in 1957.

The Sixties

When the legislature again failed to act in 1961, the League of Women Voters, using data from the 1960 census, readied a carefully drawn initiative for the 1962 election. However, it failed to pass by 44,000 votes out of 838,000 cast on the measure. Low voter turnout and determined opposition mounted by farm groups and rural interests contributed to the defeat. Some supporters also felt that even if the initiative were adopted the legislature would again emasculate it as it had the 1956 measure.

Even before the 1962 election an important new force entered the picture — the courts. With *Baker vs. Carr* in mind a suit was filed in federal court in June 1962 challenging the state legislative and congressional district patterns. The initiative defeated, proponents of a new law rallied around court intervention. In a historic decision the court dismissed the complaint against the congressional districts but found "invidious discrimination" in the legislative districts and ruled them unconstitutional. But the court avoided immediate direct intervention by giving the legislature, scheduled to convene in January 1963, a chance "to discharge its constitutional mandate."

The Democrats had a large margin in the Senate and a 51 to 48 majority in the House. But seven Democrats in the House joined with the Republicans to form a coalition. The coalition managed to pass its own bill which afforded much protection to Republican incumbents as well as to the seven defecting Democrats. But the House and Senate refused each others' plans. The court's patience and prodding were obviously not enough to force legislative action. In effect the ball was now in the court, and it had to decide what to do about it.

The balance of 1963 and 1964 was replete with political thrusts and counterthrusts and appeals between the courts, the legislative leaders, and the attorney general. In May 1963 the Federal Court responded with a decision expressing disappointment with the legislative inaction and declared all 1957 redistricting laws null and void, but said it would not undertake the reapportionment itself. After a year of appeals the U.S. Supreme Court affirmed the lower court's ruling.

In July 1964 the District Court said some judicial action had now become necessary and it noted such alternatives as court redistricting, at-large elections, and weighted voting in the 1965 legislature. In October during the election campaign, the court dropped all these options and ruled that redistricting must be made the first order of business at the 1965 session and that legislators elected in 1964 could serve only one year. The court later removed the one year restriction but said the legislature could take no final action on bills until it had acted on reapportionment.

The 1964 election resulted in large Democratic majorities in both houses, the demise of the House coalition, and placing Republican Daniel J. Evans in the governor's office. In contrast to Governor Rosellini, his predecessor, Evans heavily involved himself in apportionment matters and judiciously used both the veto and threat of it to

force Democratic majorities into compromises affording protection of Republican interests. By this time the legislature was also convinced that the court would be certain to redistrict if it failed to do so.

After 47 days of hectic bargaining between the Governor, Senate and House Democrats, and a generally united Republican party, a redistricting bill was passed. The Senate vote was largely along party lines. But it took an ad hoc House coalition of 39 Republicans and 17 Democrats to gain acceptance of the Senate bill. The Governor quickly signed the bill to cries of many House Democrats that they had been "sold down the river." The court accepted the measure but noted it was short of "mathematical perfection" and called for a more representative apportionment after the 1970 census. Although the court had retreated over the months, it had kept pressure on the legislators to redistrict. Without court intervention, most legislators later admitted, redistricting would not have been accomplished.

The 1965 law extensively reshuffled seats; only four of the 49 senate seats remained the same. Five of the 49 senate and 15 of the 99 house seats were moved from one part of the state to another. All but two of the districts remained within a deviation of 15 percent.

One of the most significant aspects of the 1965 law was a pragmatism which was designed to protect incumbents and current party voting strength. The fact that the big gainers were the suburbs, however, provided an edge for Republicans. They increased their strength from 39 to 55 and won control of the House in the first election following redistricting (1966). With only half the Senate due for reelection, the Democrats lost three seats but still controlled the Senate 29 to 20.

The Seventies

After the 1970 census, the legislature was unable to agree on a plan in one and one-half years of research and deliberation. A Seattle attorney, George Prince, filed suit in federal court as a private, ill-represented citizen, requesting that the court appoint a Master to redistrict if the legislature had not acted by February 25, 1972. The court accepted the request, and took over the task when the legislature failed to meet the deadline.

My appointment as Special Master, being a geographer, was unprecedented. The task has more often been performed by political scientists, using political criteria, or by planner/consultants. The court felt that political scientists would want to study the whole complicated history of conflict and decision-making in the case, but that the drawing of equal population regions was a technical task, subject to demographic and geographic rather than political criteria. The choice of a geographer was apparently incidental to some local publicity for the University of Washington Geography Department and its earlier work in political geography (Teshera 1970). My choice resulted from an interest and experience in population studies and spatial analysis.

The 1972 Washington Plan

The 1970 census again revealed a dramatic population shift, not only from rural to metropolitan areas, but out of central cities within metropolitan areas (Seattle, Spokane, and Tacoma). The discrepancies in population per district ranged from plus

ninety-seven percent (134,000) to minus thirty-six percent (44,000) around the ideal size of 68,495. Only one district was within one percent, and forty-four of the forty-nine were more than five percent over or under par.

The legislature did devote great effort to redistricting in its 1971 and 1972 sessions. The Senate under Democratic control passed a bill admittedly designed to maintain and extend Democratic control, and the House, under Republican control, similarly passed a bill designed to help Republicans capture the Senate and extend control in the House. Under threat of the suit, *Prince vs. Kramer,* the parties attempted to work out a compromise before a court-set deadline of February 25, 1972, but they failed to resolve conflicts in the cities of Spokane and Seattle, where population loss threatened long-established Democratic districts.

The court allotted only one month for completion of the redistricting effort and ruled out any professional outside help. The court also laid down a fairly confining set of criteria and conditions. In approximate priority these were:

(1) Lay out forty-nine districts, each to elect one senator and two representatives. The reduction of one representative shocked the legislature, but made the job much easier;
(2) Allow a maximum of only one percent (plus or minus 685 around 68,495) deviation in population;
(3) Maintain to the extent possible the integrity of counties, cities, census county divisions, and census tracts. Enumeration districts outside urban areas and blocks in urban areas were the smallest units permissible. Electoral precincts were excluded as possible units, since no census data were collected for them;
(4) Form the districts as compactly as possible and avoid unnecessary irregularities or sinuosities;
(5) Avoid crossing natural geographic barriers, especially such bodies of water as Lake Washington and Puget Sound; extend no district across the crest of the Cascade Mountains except along the Columbia River;
(6) As far as practical reflect some unity of character or interest — in particular, Indian reservations should not be split, and as much of the Seattle "Central Area" (Black ghetto) should be included within one district as possible;
(7) Not even officially noted was the very practical criterion of a "conservative" redistricting — changing the existing pattern as little as needed to meet the essential criteria. The utility of this criterion was understood, however, both in order to avoid unnecessary antagonism and litigation from legislators, and so that election officials and voters would not be confronted with an entirely new situation.

I was expressly forbidden to have contacts with any political figure, in or out of the legislature, or with the press; to know where any incumbent legislator might live; and to have access to any precinct, district, or other data on voting behavior. All political criteria, as such, were proscribed. No attention was to be paid to the question of political balance that most mattered to legislators. Because of the highly charged atmosphere in the case, however, and because bills had already passed each house of the legislature,

intervening parties were permitted to make "representations": the preexisting pattern of districts and the Democratic and Republican plans. In order to avoid the risk of political "contamination," however, I completed a basic plan before studying the Democratic and Republican plans.

Redistricting Methodology

My preconception of the ideal solution of redistricting was to write a sophisticated computer program which would brilliantly solve the task in Washington and bring fame through widespread application. Unfortunately, I was given but one month for the task. The first week had to be devoted to editing census returns: the exclusion of a transient military population of about 60,000, correction of various population totals caused by earlier misallocations of blocks and block groups, translation of census maps, and creation of "building blocs" of population for use in computer analysis. Not surprisingly, except for the Metropolitan Map Series at one extreme and the state minor civil division map at the other, maps were generally poor, and several days were used for map preparation.

A considerable literature has accumulated on the use of computers in the redistricting process. In the short time available, we were able to experiment with only a few and to only a limited extent. Our experimentation was limited to three computer programs: REDIST, a version of a grouping algorithm written by Waldo Tobler (which should not be confused with the National Municipal League REDIST); NETFLO, a version of the transportation or assignment problem; and EX6060, a version of the Revelle "location-allocation" algorithm (Revelle and Swain 1970). Tobler's REDIST, a contiguity-constrained grouping algorithm of ingenious design, led to some unacceptable irregularities in shape and population.

The transportation problem has the advantage of easily incorporating an equal population constraint. The main problem is that possible locations or "centers" of districts must be predetermined, which is, of course, the redistricting problem itself. I tried this program with two possible sets of 49 destinations (district centers) and 150 "origin areas." A fairly common, and impermissible, result was the crossing of the Cascade crest by adding parts of metropolitan counties in the west to districts in eastern Washington, the crossing of bodies of water (especially Puget Sound), and even some cases of discontiguity.

Because of the very short time, the large number of subdivisions (at least 2,000 enumeration districts or block groups), the need to consider functional unity or cultural homogeneity of districts, natural geographic constraints, great topographic diversity and irregularity, and extreme population density variation, it was not feasible to write an adequate program. Because of the desire to cause as little change as necessary, a manual, somewhat intuitive, patient, experimental approach proved best. I first determined sets of counties which comprised an integral (exact) number of districts, both according to the preexisting districting plan, and according to current population. This revealed a gross pattern of gains or losses of districts for these sets of counties. Within each set, I then delimited districts according to the criteria given by the court.

At a gross level the necessary changes were simple; eastern Washington had to lose two districts, including one from Spokane. Western Washington outside of metropolitan Puget Sound neither gained nor lost representation. The city of Seattle lost two districts, but its suburbs gained three, one each to the north, east, and south. This typical city-to-suburb shift alone suggests a reason for the inability of the legislature to

agree upon a plan and for the initial unhappiness of the Democratic Party with the court adopted plan. Other things being equal, Democrats stood to lose the three seats which shifted from poorer central cities to more affluent suburbs.

The Court Plan

Unlike the strategy for painting a floor, laying out legislative districts for a state proved easiest by beginning at the corners and converging at the center. Not surprisingly, the real "center" of the state is not in the open spaces of central Washington, but Seattle. In accordance with the court order, and the accident of numbers, I formed seven sets of legislative districts into the required congressional districts. Several alternative patterns of congressional and legislative districts were drawn up, analyzed, and rejected because achieving equal population either made shapes too irregular or required crossing too many county or city boundaries. An east-west division of eastern Washington was made for a crude separation of a more "irrigated" west and "dry-farming" east (there is significant overlap in reality), but with respect to transport corridors and functional allegiance a north-south division would have been equally defensible (the north dominated by Spokane, the south by Pasco, Kennewick, Richland, and Yakima). The loss of two legislative districts from eastern Washington required the Fourth Congressional District to reach west and include most of metropolitan Vancouver, thus forcing the Third to include all the Olympia peninsula and to expand into either the Bremerton area or the Seattle-Tacoma suburbs. I made the Third district even more extensive by including rural (exurban) portions of King (Seattle) and Pierce (Tacoma) counties, making the district a predominantly rural-small city one, and did not remove the Bremerton area from its traditional association with Tacoma in the Sixth district.

The greatest practical difficulty in the actual delimitation process proved to be the typically awkward shape and "excess" population of enumeration districts in non-metropolitan areas and the catch-all "900" level blocks in metropolitan suburbs. Since these often contain 2,000 or more people it proved impossible to bring all districts within the one percent deviation limit ($\pm$ 684) without some irregularity. This is apparent from the resulting plan (Figures 9 and 11). The details of the plan are of interest only to local residents, but it is useful to comment on how well the criteria could be met.

Compactness. The maps show some rather linear districts, but the districts are fairly compact with respect to densely inhabited areas and the pattern of transportation.

Irregularity. The constraint against sinuosity was not met to an aesthetically pleasing degree in some cases because of the indivisibility and crooked shape of enumeration districts and blocks, and the stringency of a one percent maximum population deviation.

Crossing Boundaries. Fifteen counties were divided, seven because the population of the county did not divide into an exact number of districts. The others were divided mainly because of the stringency of the one percent maximum deviation. The divisions were placed in sparsely populated areas far from nodal centers. Only the larger cities had districts crossing their borders, again because of their inconvenient populations.

Geographic Barriers. Because some counties cross Puget Sound or include islands, some water crossings were unavoidable. The most difficult case involved Island County, which I attached compactly with parts of Snohomish. The preexisting plan attached Island to the peninsula area north of Bremerton, violating the court

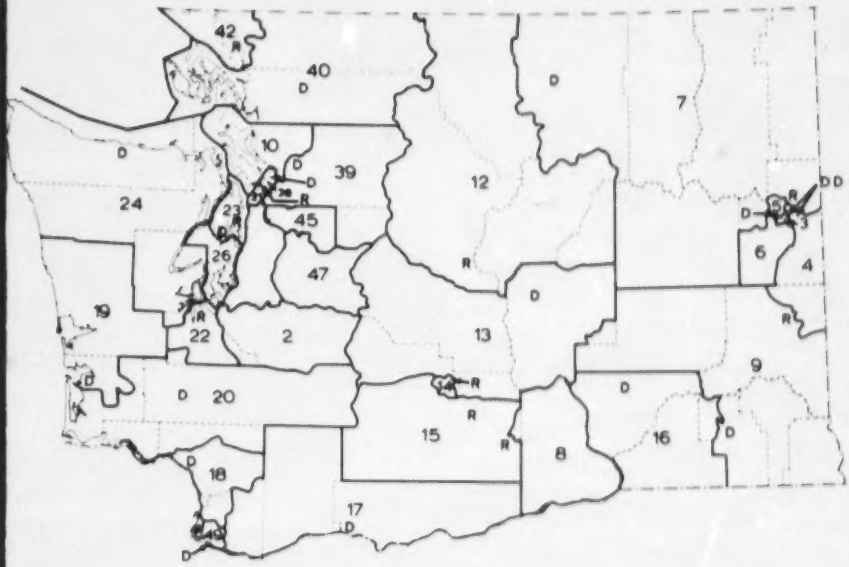

FIGURE 9 COURT PLAN: WASHINGTON LEGISLATIVE DISTRICTS, 1972 (Morrill 1973a: 470). R, D = Party and location of incumbent legislators.

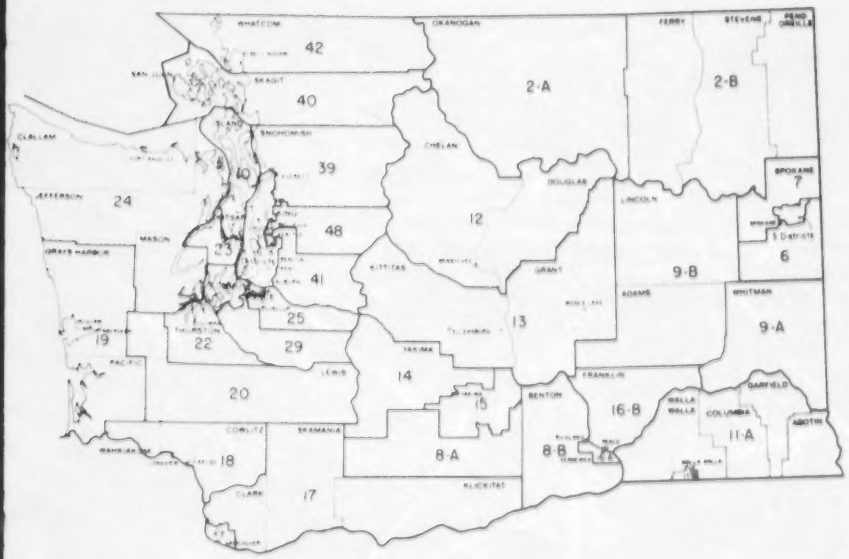

FIGURE 10 WASHINGTON LEGISLATIVE PLAN, 1965 (Morrill 1973a: 471)

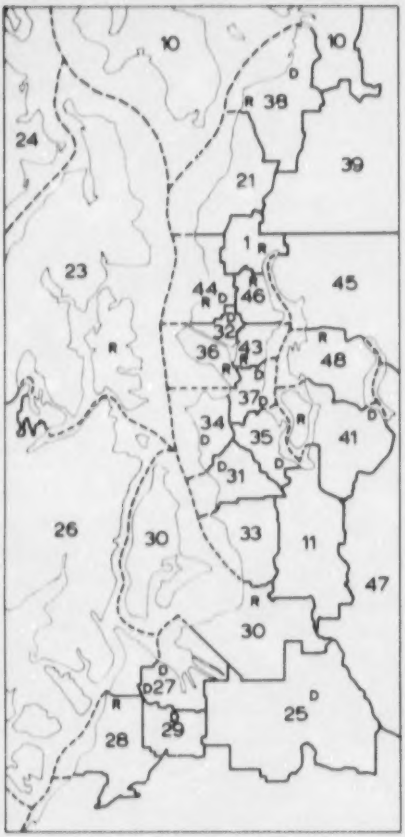

FIGURE 11 COURT PLAN: SEATTLE AREA LEGISLATIVE DISTRICTS, 1972 (Morrill 1973a: 474)

guidelines; the preferred solution of attaching the county northward to functionally-related Skagit County was impossible. The three northern counties already comprised two districts.

Homogeneity and/or Unity. Efforts to form meaningful regions were made difficult by the overriding criteria of equal population, compactness, and regularity. Indian reservations were kept intact, and as much of the Black population was kept together in one Seattle district as was possible. In metropolitan counties, rural, suburban, and central city constituencies were separated, thus sacrificing some city representatives (Seattle and Spokane) whose districts might have been extended in a long wedge through the suburbs. In non-metropolitan counties, approximations to trade areas, pairs of trade areas, or halves of trade areas (where the population was too large for one district) were often possible. In metropolitan areas, some districts were nodal, but more often districts were zones of fairly homogeneous residential and socioeconomic character; many were both reasonably nodal and homogeneous.

Relation to Previous Districts. Contrary to initial newspaper headlines proclaiming the revolutionary and drastic changes the plan would cause, it is in fact conservative, disappointingly so to some critics who would like to have seen the legislative slate

wiped clean. Despite dramatic population shifts, less than one-fifth of incumbent senators or representatives were placed in the same new district. Previous districts may be compared with the court plan (Figures 9 and 10). Some legislators felt that I had deliberately drawn the boundaries to place them just outside their former districts, but I was absolutely unaware of where any incumbent lived.

Comparison of Plans

The Democratic plan was designed to retain or strengthen Democratic control of the Senate and the seats of certain party leaders, despite unfavorable population shifts. One reason for the inability to reach a compromise with the Republican house was this bias in the Senate bill. The House Republican plan was similarly designed to aid Republican interests, especially to gain control of the Senate. Because of the population shifts, the task was not so difficult for the Republicans, and their plan is less obviously gerrymandered, although no less political.

The compactness and irregularity of the court plan, as well as of the Republican and Democratic plans have been evaluated (Manninen 1973). Fortunately, the court plan fared well. In general, the court plan proved to be about one-third better than the Democratic plan, but rather worse than an ideal of all districts as perfect squares.

The Democratic and Republican plans predated the court order, and were not under any legal constraint in respect to natural geographic boundaries. The Republican plan did not have districts crossing the Cascades but crossed Puget Sound in two places (one with a bridge). The Democratic plan created three cross-Cascade districts in order to maintain eastern Washington incumbencies (of both parties). The districts were grossly misshapen, and one even lacked any road from east to west.

A homogeneity criterion, namely safe districts of fairly uniform socioeconomic status, was apparent in both plans. The Republican plan maintained a strong ghetto district and sacrificed a Democratic senator in the process, as did the court plan. The Democratic plan, in order to save the incumbent, separated the growing southern from the main northern part of the Black community.

To the legislator and the political parties, the impact on Republican and Democratic electoral prospects was of overriding import. The state is rather evenly balanced between the two parties; party loyalty is extremely weak; personalities and local issues typically predominate. Rural areas in Washington are at least as Democratic (although conservative) as Republican. Some cities vote Republican and some suburbs strongly Democratic. Thus fairly small district realignments can cause major changes in party fortunes or have very little effect, and prediction is hazardous. The Democratic and Republican plans were beneficial to their parties, showing evidence of concentrating opposition strength in "safe" districts. The proposed court plan was clearly in between, weakening the Democrats in the Senate, but not in the House, and reflected closely the population shifts of the last decade. It most closely approximated actual voter behavior in recent elections.

The Late Seventies

After such speculation, it is instructive to discover how the voters themselves acted. Democratic critics of the court plan fell silent after unexpected Democratic gains in both houses. The change, however, was evidently caused by an increase in the total Democratic share of the vote for legislative candidates, without which the court predic-

tions should have been quite close. The court plan did, of course, affect the fortunes of individuals and local areas, because of the underlying shifts of population. The large cities of Seattle, Spokane, and Tacoma all lost some representation and power, as did some rural areas. Some incumbents were placed against other incumbents, resulting in the loss of direct representation for slow growing or declining regions. Surprisingly, the expected Republican gains from the suburbanization of districts did not occur in 1972, but did appear later in the decade.

During the 1970's, the plan became "institutionalized," familiar and accepted. Bills were periodically introduced in the legislature to create a non-partisan redistricting commission, but the issue seemed too remote for action. Only in 1980 was a bill taken seriously.

In 1976, concern with an underpaid, part-time legislature, officially meeting only sixty days every two years, led the Young Lawyers of Washington to propose an initiative to create a full-time legislature of reduced size, 35 senators and 70 representatives. I was asked to prepare a plan for the initiative, but insufficient signatures were obtained to place the initiative on the ballot.

The Eighties

Hearings on redistricting by the Washington Legislature in 1981 revealed both good and bad features of the 1972 plan after a decade of implementation. At the time it was proposed the 1972 plan was denounced by Democrats as favoring the Republicans. However, Democrats dominated both houses and six of seven congressional seats for six years (the 1972 through 1978 elections). The 1978 election resulted in an evenly split House (49-49), and a successful experiment in joint leadership. In the 1980 elections the national shift to the Republicans together with serious leadership scandals among the Democrats resulted in a clear Republican victory in the House. The initial line-up in the Senate was 25 Democrat to 24 Republican, but a Democratic defection soon gave the Republicans complete control (Governor and both legislative houses).

These results reinforce the conclusion that the set of districts were quite competitive. About half the districts could and did shift between parties in different races, and about one-third of districts elected both a Democrat and a Republican representative or senator. This competitiveness should be considered the prime virtue of the 1972 plan, as it tended to heighten responsiveness to voter interests. It did not result in excessive volatility or turnover, as might be feared or expected, because of very high loyalty to individuals.

In 1981 the House established a Select Committee on Redistricting which held hearings on criteria for redistricting and on a redistricting commission. The hearings on criteria brought out the main complaints against the 1972 plan. Citizens and officials from several counties and cities complained about the splitting of their jurisdictions. The "blame" for this can be placed on the U.S. District Court, which required that district populations be within 1% of the standard. This excess precision resulted in inescapable distortion and unnecessary and unfortunate division of several counties and cities. However, I will also admit to a gradual shift over the decade in my attitude toward the greater importance of city and county integrity, and that now I would avoid some city, if not county, splits. By far the most unpopular, and admittedly poor split, was of the city of Auburn, which was split among four districts.

The court plan attempted to respect political boundaries and communities of interest, but it may be validly criticized as excessively "geometric" — that is, too rigidly equal in population and territorial compactness, and thereby neglecting community aspects. The fault here lies with the mood of the courts in 1971!

The Next Redistricting Battle

In the 1978-79 legislature, serious attempts were made to enact a provision for redistricting by commission. A rather good model bill was passed by the House, but was held from consideration by the Democratic Senate leadership, who failed to read the signs of a gradual shift toward the Republicans. Thus, after assuming control in 1981, the Republican supporters of the commission became uninterested, while the minority Democrats suddenly supported a commission. The conversions were hardly surprising, and the Republicans fully intended to use their position of power to maximize their strength, just as the Democrats would have done if they were in a similar position.

The hearings on criteria for redistricting were valuable and educated both legislators and citizens. I strongly supported the emerging concern for "geographic communities of interest." However, it became obvious that the dominant Republicans of the committee chose to interpret community of interest as partisan political allegiance only and therefore as justification for the consequent political gerrymander.

The 1980 redistricting was designed to be highly political and computer-dependent. The 1979-80 legislature directed the Secretary of State to prepare a "correspondence list" between political precincts and census geography (blocks and enumeration districts), which turned out to be a horrendous and expensive chore, although potentially useful for many other administrative and research purposes. The Republicans then contracted with the Rose Institute for State and Local Government (Claremont, California) for an interactive computer system for forming and evaluating sets of districts. However, the time urgency of the Republicans and serious data and map problems prevented the use of this technology. While seeking my advice on such technical matters, my "non-partisanship" was greatly feared. The Republicans were determined to do the plan, in secret, themselves. An added element in 1980 was that Washington was to be apportioned an 8th congressional seat. The Republicans were determined to get this 8th seat, as well as to shift the existing balance (5 Democrats, 2 Republicans) in their favor.

The plan was introduced and passed in one day, without hearings. Even discounting my expected prejudice, the plan must be viewed as a travesty, a blatant gerrymander designed to protect some incumbents and punish others. Dozens of cities and counties are unnecessarily divided, in total disregard of the criteria adopted by the committee. The congressional district portion of the bill was unanimously opposed by the congressional delegation of both parties and was vetoed by the Governor. The legislative portion, which was signed by the Governor, will be subject to an initiative campaign.

8

Redistricting and Place

There are thousands of units of government in the United States affected by the chain of decisions that began with *Baker vs. Carr* in 1962 — a true "reapportionment revolution." The task of defining districts may be reduced to a sterile computer manipulation of the numbers, ignoring the social fabric of a region or its political reality. On the other hand, it may be reduced to a crude manipulation of voters for the perpetuation of individual incumbency or partisan exclusiveness.

It has been necessary to correct the gross imbalance of malapportioned districts and the blatant discrimination against minorities in gerrymandered districts, but this redress does not prevent the system of electoral districts from being arbitrary aggregations of the appropriate numbers of voters.

The purpose of this essay has been to show that the problem of redistricting is more interesting and more important. This task deserves professional competence including geographic understanding of the role and meaning of territory to human societies. Electoral districts are temporary, and legal constraints make it impossible to devise ideal regions. But it is at least possible to devise plans that are responsible to office-holders, to voters, to legitimate community interests, and to a sense of territorial integrity.

Perhaps we have departed too far too quickly from an earlier tradition in which it was the people *of* a political-cultural territory who had representation. Perhaps this is an obsolete notion in an age of mass international communication, but the evidence of other social and geographic processes — the rise of community organizations, the massive shift of people to smaller communities — reveals the fundamental desire of people for a sense of place, of belonging to a community and having a deep concern for one's locality or region. The absence or loss of this sense of community is part of the malaise of modern society. More careful attention to the drawing of electoral districts is one way of responding to these needs.

Apportionment of House Seats

It is commonly thought that the number of seats to which a state is entitled is simply the population of the state divided by the mean size of congressional seats. However, each state must have 1. Thus a criterion is needed to decide when a fractional entitlement should be rounded up or down, and a "method of equal proportions" was adopted by Congress in 1941. Now 50 seats are set aside, 1 to each state, and the remaining 385 allocated to the states according to a formula which minimizes the *proportional* difference in the number of persons per representative among the states. In practice, this has the effect of favoring smaller states over larger.

For example, consider a country with 2 states, A with 11,000,000 population and B with 1,100,000. If 16 seats were to be allocated, at an average size of 757,000, then by simple division, A deserves 14.55 and B 1.45. But will A get 15? Not by the method of equal proportions. B has a higher priority of getting a 2nd seat than A does of getting a 15th:

$$\text{Priority}_i = \frac{\text{Population}_i}{\sqrt{(\text{Seats}_i)\ \ (\text{Seats}_i - 1)}}$$

$$\text{Thus, Priority}_A = \frac{11{,}000{,}000}{\sqrt{(15)\ \ (14)}} = 760{,}000;$$

$$\text{Priority}_B = \frac{1{,}100{,}000}{\sqrt{(2)\ \ (1)}} = 780{,}000.$$

If A were to get 14 and B receive 2, then the population per representative is 785,714 and 550,000 respectively for proportional differences of 28.7/757 or 3.8% and 207/757 or 27.7% compared to greater proportional differences of 24/757 or 3.2% and 343/757 or 45% if A received 15 and B only 1.

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